ENGINEERING CONSTRUCTION WEEKLY

McGRAW-HILL PUBLISHING COMPANY, INC. · TWENTY-FIVE CENTS, FIVE DOLLARS PER YEAR

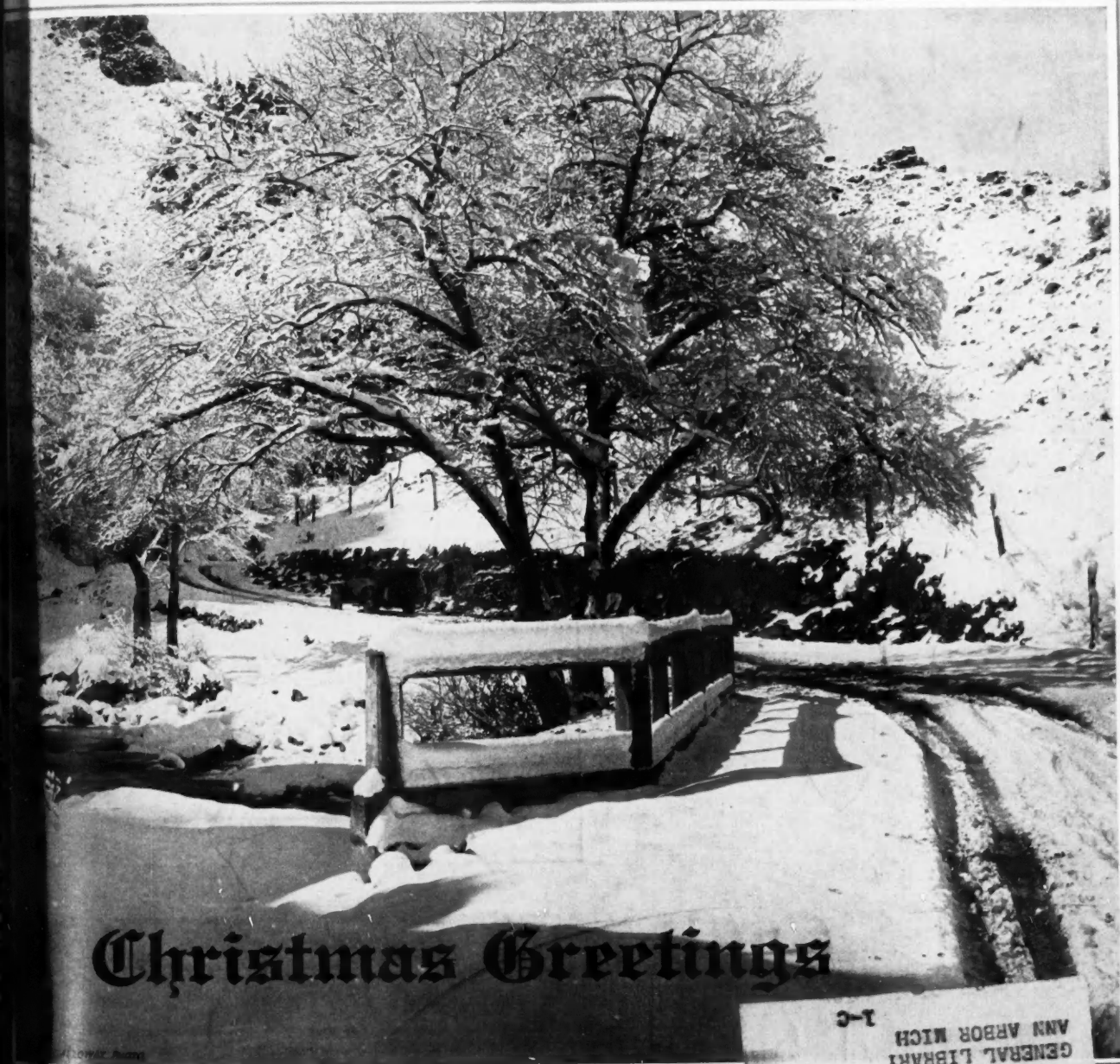
DEC 24 1937

Engineering Library

Engineering NEWS-RECORD

December 23, 1937

BRIDGES · IRRIGATION · FLOOD CONTROL · FOUNDATIONS · DAMS · HIGHWAYS · WATERWORKS · STEEL · TUNNELS



UNIV OF MICHIGAN
GENERAL LIBRARY
ANN ARBOR MICH
J-C

Pygmies if judged by weight, but giants in strength, are these products of the Utility Mine Equipment Company of St. Louis, Missouri; a rail punch, a spike bar, and a bender suitable for use on rails as heavy as 100 pounds. Each is capable of doing work formerly accomplished only with equipment weighing two to three times as much.

Little Giants

The ease with which the tools can be handled makes it possible for one to do work which previously required at least two men. Alloys of Alcoa Aluminum made possible the production of equipment having the necessary high strength in combination with the natural lightness of Aluminum. ALUMINUM COMPANY OF AMERICA, 2108 Gulf Building, Pittsburgh, Pennsylvania.

★ ALCOA ALUMINUM ★

ALCOA · ALUMINUM

From Relief to Reemployment

SOME WEEKS AGO this page commented on the program then announced by Col. Brehon B. Somervell, WPA Administrator for New York City, to train certain WPA workers for greater efficiency on relief projects and to help fit them for private employment. It ventured the hope that the program might be extended to the construction projects.

No sooner said than done! Colonel Somervell now announces a program of training for 6,300 foremen and supervisors of which 5,000 are construction men. Forty picked men have been trained to conduct classes of construction foremen throughout the city, each group of twenty-five meeting once a week after working hours. They will discuss "the best methods of getting work done, how to deal with dissatisfied men and how to handle administrative and labor problems." It is hoped by Colonel Somervell "that the benefits of improved leadership will communicate themselves to all of the 135,000 workers. In that way we shall not only increase our own efficiency but we shall improve the equipment of both foremen and men for private jobs."

THIS TREND in WPA practice is not confined to New York. From J. E. Kaulfuss, Director of Pennsylvania's State-wide Highway Planning Project, we learn that on his work he "made distinct efforts to assign employees to work along their skills or training and for their future benefit, to reward achievement wherever possible, and particularly to encourage and aid all who would or could secure regular jobs both in private and in other public service."

Another comment from R. O. Beckman, Director of Foremanship Training of the WPA, cites work along that line in many states. To date, he writes, more than 15,000 foremen have been in training in seventeen states. Reports from WPA Administrators in those states indicate a widespread satisfaction with the training conferences because of the higher morale and increased efficiency shown on the projects.

Such efficiency is a worth while objective that in itself would justify the effort. But to this writer the other objective, that of equipping WPA workers for private employment, is even more important. If ever we are to deal successfully with unemployment, it is just as necessary to get employables *off* relief as it is to care for them *on* relief. And to accomplish that we must do our utmost to help them make good on private jobs.

It is reasonable, therefore, to recognize that the merit of an administrator cannot be judged *solely* by the efficiency with which he operates his project. That, of course, is important, but in rating his performance we should take into account also the number of those he has helped to reinstate in private employment. As Prof. Kaulfuss points out, "it takes a certain amount of principle and grit to help one's best men leave him. The good ones always go first and the work is left with a lower grade personnel through this meritorious release of good and key men. * * * This self-decimation of a satisfactory personnel gives the critics more proof of inefficiency, whereas forebearance and consideration are deserved."

FROM TIME TO TIME this writer has urged that the key to technological unemployment be sought in the systematic reconditioning to new skills of those who may be displaced by changes or obsolescence in their accustomed callings. It cannot be found in any scheme to support them in idleness or by trumped-up jobs financed by taxation on those regularly employed. If WPA can and will shift its emphasis from the relief to the reconditioning aspect of its work, it may yet provide the framework for a genuine agency of *re*employment. And such an effort would deserve the wholehearted cooperation of enlightened business and industry, for it would be a long stride toward a true solution of the problem raised by the impact of technical progress on specialized skills.

The only lasting cure for *un*employment is productive *re*employment; it never will be found in any defeatist program of indefinite support at the public expense.

Willard Chevalier

ENGINEERING NEWS-RECORD

Published every Thursday. Vol 119, No. 26. Price 25c per copy. Subscription, domestic, Canada, Mexico, Central and South American countries, $5 per year. All other countries, $9 a year or 36 shillings. Entered as second-class matter October 29, 1936, at the Post Office at Albany, N. Y., under the act of March 3, 1879. Printed in U.S.A. Cable address "McGrawhill New York." Member A.B.P. Member A.B.C.

Copyright 1937 by McGRAW-HILL PUBLISHING COMPANY, Inc.

Editorial and Executive Offices: 330 West 42d St., New York. Publication Office: 99-129 N. Broadway, Albany, N. Y. Branch Offices: 520 N. Michigan Ave., Chicago; 883 Mission St., San Francisco; Aldwych House, London, W. C. 2, England; Washington; Philadelphia; Cleveland; Detroit; St. Louis; Boston; Atlanta, Ga.

JAMES H. McGRAW, JR., *President* HOWARD EHRLICH, Exec. Vice-President JAMES H. McGRAW, Honorary Chairman
WILLARD CHEVALIER, Vice-President B. R. PUTNAM, Treasurer D. C. McGRAW, Secretary A. W. MORRISON, Circulation Manager

Now... AMER

LEVELING AND FILLING — *Two "Caterpillar" Diesel-powered shovels load the rocky material onto Athey dump-wagons, pulled by "Caterpillar" Diesel Tractors.*

CATERPILLAR

REG. U.S. PAT. OFF.

WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES, TRACK-TYPE

· ENGINEERING NEWS-RECORD ·

McGraw-Hill Publishing Company, Inc.

Willard Chevalier, *Vice-President*

Editorial and Executive Offices: 330 West 42nd Street, New York . Publication Office: 99-129 North Broadway, Albany, N. Y.

F. E. Schmitt, *Editor* Albert E. Paxton, *Manager*

Copyright 1937

Vol. 119 *DECEMBER 23, 1937* No. 26

THIS WEEK AND NEXT

MIDDLETOWN, Conn. recently placed in operation a sewage disposal plant featuring some of the latest mechanical aids in treatment. Design of an intercepting sewer and the plant details are included in the article on page 1011.

Movable bridges are scarce in Montana, but the clever design of the state's lone swingbridge makes up for the deficiency in number of structures. The Army Engineers at Fort Peck built it in a hurry from materials available on the job for service over a dredge cut to new borrow pits, working out an unusual and interesting jacking and bearing arrangement for swinging the span.

A definite need for reliable grout pumps on large western dam jobs has caused engineers to study sump pump design details carefully with an eye to improvement at points where frequent need for repair has held up work. Two Bureau of Reclamation engineers describe experiences in curing chronic ailments of the pumps.

Michigan's ice-belt keeps state highway engineers busy devising means for making rural highways safe for drivers. Use of treated sand and a spreader arrangement on dump trucks helps them considerably in providing this service.

The staggering proportions of Grand Coulee Dam are brought home to News-Record *readers on page 1021. A list of Coulee articles previously published in this magazine is included.*

The consensus of the Memphis National Asphalt Conference was that wider bituminous research is needed.

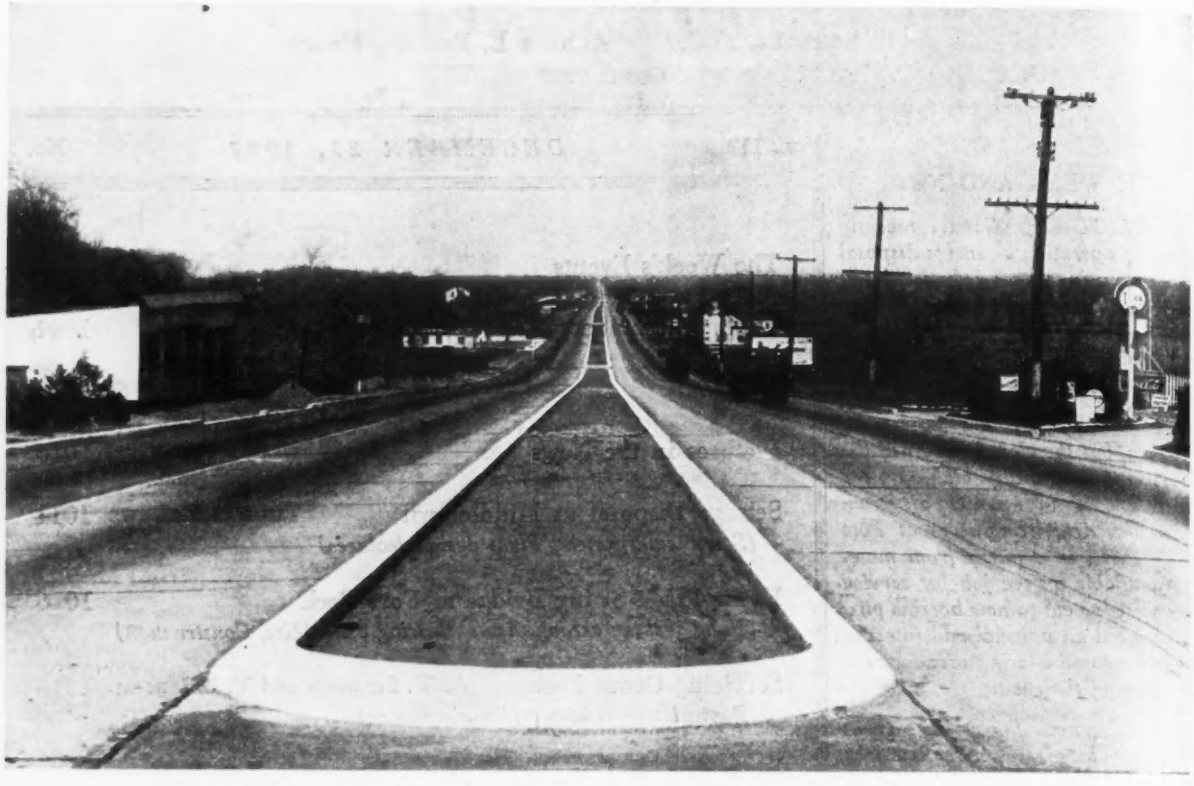
NEXT WEEK—"Salvage from Sewage" is the self-explanatory title of an article based on a report given at the 1937 American Public Health Association meeti-

		PAGE
The Week's Events		999, 1031
Reader Comment		1007
Editorials		1008
Pictures in the News		1010
Sewage Disposal at Middletown *(Sewer enlargement, Plant design features)*	Thomas F. Bowe	1011
Home Made Swing Bridge at Fort Peck *(Hand jacking arrangements, Bearing assemblies, Construction)*		1016
Servicing Grout Pumps *(Pump liners, valves and maintenance)*	A. W. Simonds and V. L. Mineah	1018
Removing Ice from Roads *(Highway safety, Surface treatment, Equipment)*	Murray D. Van Wagoner	1020
Grand Coulee High Dam *(Contract figures, Dam design features)*		1021
A New Stadia Rod Technique *(Surveying)*	John A. Oakey	1025
From Field and Office		1026
Bituminous Roads Studied		1028
Unit Prices		*Adv. page* 20
New Aids to the Constructor		*Adv. page* 24
Construction Reports		*Adv. page* 29

The Staff of *Engineering News-Record* join in extending to its readers the season's greetings.

Number of copies of this issue printed: 32,202

First Cost is Last Cost



Curbing made of Atlas White portland cement on Brunswick Pike, New Brunswick, N. J.
Constructed by New Jersey State Highway Department

This curbing will stay white permanently. It requires no maintenance, no repairs, no replacement

● This is a safe, well-engineered highway. Traffic flows on either side of the center island with no possible danger of head-on collisions.

One big safety factor is the fact that the curbing is white. More than that, it is *permanently* white, because it is made of Atlas White portland cement. Painting will never be necessary.

When Atlas White curbing or traffic markers go in, maintenance worries go out. They require no repairing or replacing. Their whiteness never dims, never washes away. They stay white year after year, clean-cut, easy-to-see guardians of life and limb.

Use Atlas White for your next curbing or marker job. It is your assurance of built-in permanence and safety at low cost. And the first cost of curbing or traffic markers made with Atlas White is the last cost. Universal Atlas Cement Co. (United States Steel Corporation Subsidiary), 208 South LaSalle Street, Chicago.

USS

M-13

ATLAS WHITE PORTLAND CEMENT FOR MARKERS AND CURBS

THE WEEK'S EVENTS

Planning Authorities Hearings Held

Morgan and Schley testify on bills to set up seven regional authorities

Reversing its usual practice, the House Committee on Rivers and Harbors held an unannounced executive session Dec. 17 to receive the testimony of Arthur E. Morgan, chairman of the Tennessee Valley Authority, on the pending bills to set up regional authorities to develop water resources.

Although Dr. Morgan's testimony was "off the record," it is understood that he advocated limiting the proposed legislation to planning and to coordinating the work of existing agencies in the field of water development, leaving the power question to be dealt with separately. He is understood to have pointed out that power development is important on relatively few rivers, such as the Tennessee, Colorado, Columbia, St. Lawrence, and a few streams in the southeast. These special cases can best be dealt with by separate agencies without complicating the nation-wide problems of soil erosion control, flood control, domestic water supply, pollution abatement.

The committee has already indicated that the pending bills will be rewritten so as to limit the functions of the seven new regional agencies to planning, and to leave intact the present responsibilities of the Corps of Engineers and of other federal and state agencies now dealing with water problems. Chairman Mansfield has announced that this revision conforms to the desires of President Roosevelt.

Schley testifies

On the preceding day the committee heard Major General Julian L. Schley, Chief of Engineers, state that the Corps of Engineers is already doing all that the proposed authorities would be empowered to do in the fields of flood control, water conservation and power development. He declined, however, to answer a direct question as to whether the proposed authorities would deprive the Army engineers of these functions, stating that he did not understand the language of the bills well enough to make a definite statement at present.

The general also promised to submit to the committee a report upon the Norris and Rankin bills which it had previously requested, and which many believe has been held up by the Budget Bureau. A long-standing governmental regulation directs all administrative heads and government employees, before reporting to Congressional committees on pending legislation, to submit such reports to the Budget Bureau. "The submitting agency will then," reads the order, "be advised as to the relationship of the legislation or of the report or recommendation thereon, to the program of the President, and when such report is thereafter submitted to Congress or to a committee or member thereof, it shall include a statement of the advice so received from the Bureau of the Budget."

STEEL PRODUCTION BEGINS

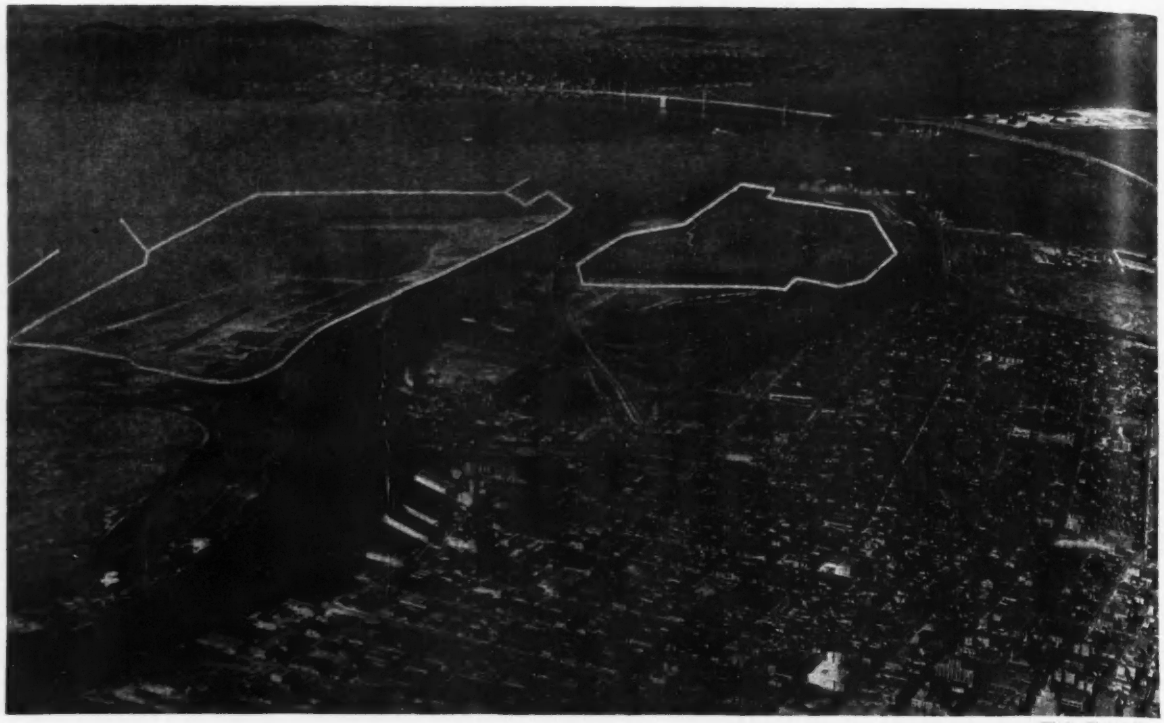
CONTINUOUS strip mill for which Jones & Laughlin Steel Corp. broke ground in April, 1936 at their Pittsburgh works is now in full operation. Above, operators may be seen controlling the manipulation of the hot mill finishing train from a pulpit built above the level of the stands of rolls; from this vantage point the men can see the progress of the steel through the mill and regulate the rolling speed to best advantage.

The new mill has a monthly capacity of 60,000 tons. It is producing hot and cold rolled sheets and wide strips as well as light plates.

St. Charles Protects Water From Missouri Drop

The city of St. Charles, Mo. found it necessary to protect its water supply by cutting a channel through a sand bar in the Missouri River in front of the intake tower of the city waterworks, as the Missouri River reached an all-time low at St. Charles of 5.5 ft. Dec. 14. Water Superintendent Hueffmeier stated that he had been advised several days previously by weather reports that the Missouri was likely to reach low stages and that he had had men working on the sand bar since Dec. 10, cutting through a top layer of ice and removing sand to create a channel 2 ft. deep, 6 to 10 ft. wide and about 400 ft. long.

The sand bar is ordinarily no obstacle to the intake tower.



Wide World Photo

A NEW NAVAL AIR BASE FOR THE PACIFIC COAST

SIZE of the new $14,500,000 naval air fleet base in San Francisco Bay dwarfs the present China Clipper airport into insignificance. The naval base is to be constructed on filled land in the area outlined in white on the left, above, while the present China Clipper base is at the spit of land in the upper right-hand corner of the air base area. The area outlined on the right is the site of the $15,000,000 Naval Supply Depot. Metropolitan Oakland occupies the foreground of the picture and San Francisco is across the Bay. The site of the 1939 Golden Gate Exposition may be seen as a flat island on the far side of the San Francisco Oakland Bay Bridge.

Jersey Water Shortage Studied by WPA

The New Jersey State Water Policy Commission has sponsored a WPA project to make an immediate survey of public water systems in the New Jersey metropolitan area to determine the possibility of interconnecting existing systems and assuring an adequate supply in periods of emergency. The State Water Policy Commission and the North Jersey Water Supply Commission recently issued a joint statement warning that a serious water shortage in the New Jersey metropolitan area is to be expected between 1945 and 1950 and that immediate steps must be taken to provide a new major supply in the five counties of Essex, Hudson, Bergen, Passaic and Union.

The survey of existing supplies will be financed by $13,737 of federal funds and $6,650 provided by the sponsors.

Information as to possible interconnections is expected by the Water Policy Commission to offer a temporary solution of the water problem through the linking of certain water supply systems now operating at capacity with those having surplus water storage facilities.

• • •

Houston Parking Meters Show Big Profits

A net profit of about $165,000 appears likely from the operation of parking meters in Houston, Texas, during 1937, it has been announced by the city tax collector. Collections for the first eleven months of the year are $197,000, which an estimated $18,000 for December will bring to $215,000.

Charges to be deducted from the year's total revenues are $4,380 for clerical help, $5,000 for collectors, $1,800 to the Parkrite Corp. for maintenance, $1,200 for municipal maintenance, $28,000 paid outright for the meters, and $9,000 paid on a percentage basis to the Parkrite Corp., a total of about $50,000 for deductions.

The city will start the new year with its meters paid for. It is now installing 53 additional meters, bringing the total to $1,985.

Model Code for Canada Planned at Conference

Formulation of a model building code for Canada to serve as a guide to municipalities in drawing up their own building codes was considered at a conference of representatives of all leading Canadian construction, architectural and engineering bodies, who were called together by the National Research Council in the interests of home building and its allied problems. The standards set up by the federal government in connection with the operations of its Dominion Housing Act were cited as a useful beginning which had come to be generally accepted even by speculative builders throughout the Dominion.

Finance Minister Dunning of the Canadian government, addressing the gathering, told the delegates that chaotic and unscientific conditions in Canada regarding existing building codes now in use were responsible for an annual loss of millions of dollars which could be saved by more uniformity among different municipalities in building codes.

THE CURRENT TREND

This week's news of contract volume and construction cost factors

Far West Volume Lower

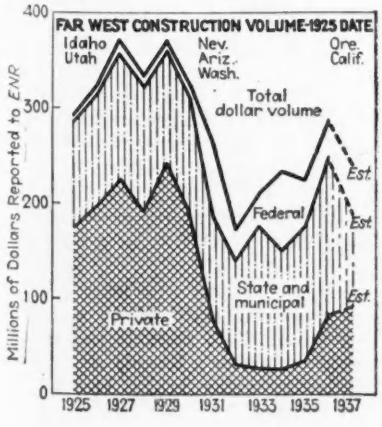
Eleven month total 15 per cent below same period last year

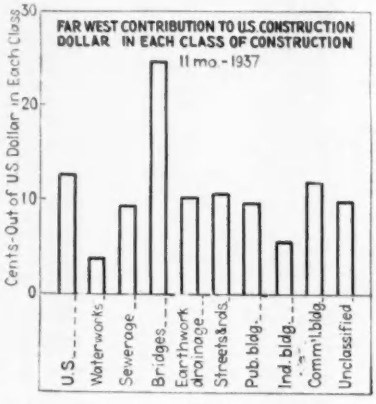
One-tenth of this year's engineering construction volume is in the Far West, Idaho, Utah, Nevada, Arizona, Washington, Oregon and California. The 11-month total, $219,616,000, is 15 per cent below the volume for the corresponding period last year. The Far West construction volume in 1929 at $371,372,000, is the all-time high, while 1932 with $174,400,000 is the lowest since 1922. The average for the 12 years preceding 1937 is $285,000,000, and 1936, with awards totalling $285,933,000, is the only post-depression year to exceed this average.

Federal construction, with its peak of $84,066,000 in 1934 when it represented 35.8 per cent of the volume of this region, is currently running at 21.0 per cent of the total. From 1925 through 1930, federal volume ranged from 2.0 to 3.8 per cent of the total, but from 1931 to 1936, it ranged from 12.9 to 35.8 per cent.

These seven states average an expenditure of 11.6c. of each construction dollar reported by *ENR* in the 12 years preceding 1937. This average is down to 9.8c. for the eleven months of 1937. This section averages 30.5c. of each waterworks dollar; 10.6c. of each sewerage dollar; 13.8c. of each bridge dollar; 14.2c. of each earthwork and drainage dollar; 11.8c. of each highway dollar; 11.1c. of each industrial building dollar; 9.6c. of each commercial building dollar; 7.8c. of each public building dollar; and 10.8c. of each unclassified construction dollar.

In the 11 months of 1937 these states contribute 12.5c. of each waterworks





dollar reported by *ENR* in U. S.; 3.7c. of each sewerage dollar; 9.2c. of bridge dollar; 24.6c. of earthwork and drainage dollar; 10.2c. of highway dollar; 10.5c. of public building dollar; 9.7c. of industrial building dollar; 5.4c. of commercial building dollar; and 11.8c. of unclassified dollar.

Building Permits

Building permits in November at $69,567,549 show a loss of 23.3 per cent from October, and 7.9 per cent from November 1936. The November permit volume is the lowest since January of this year. Cumulative permit values for the 11 months of 1937, $1,011,860,620, are the highest for any 11-month period since 1931, and are 12.8 per cent above the same period in 1936.

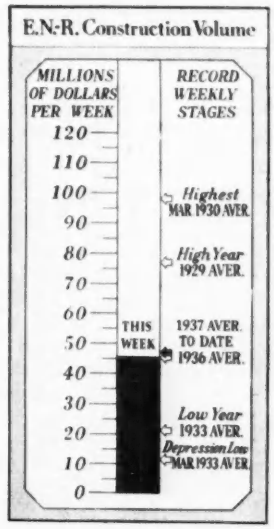
New York City permits total $19,388,948 for November, a loss of 35.5 per cent from last month, but an increase of 8.9 per cent over November 1936. Building permits in the 214 other Dun and Bradstreet cities are down 17.2 per cent from October, and 13.0 per cent from last November.

Business Briefs

OCTOBER EMPLOYMENT on Works Program projects totalled 2,063,000 workers compared with 3,252,000 in October 1936, according to the Bureau of Labor Statistics. Employment on PWA projects during October, 149,000 men, dropped 50 per cent from last October; payrolls amounted to $12,610,000 compared with $23,500,000 a year ago. On projects financed by regular federal appropriations 216,000 men were employed compared to 165,000 in 1936; payrolls during October reached $20,811,000 compared to $15,000,000 a year ago.

INDEX OF SHIPMENTS of construction materials, based on 1929=100, is 85 for October. This compares with 99 in September, and 106 in October, 1936, according to PWA Projects Division reports.

AVIATION'S INDICATOR for revenue passenger miles in air transport stands at 107.1 for October. This is 11 per cent below September, but 7 per cent above October, 1936.



THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Dec. 24 1936	Dec. 16 1937	Dec. 23 1937
Federal	$2,062	$2,585	$9,112
State & Municipal	14,137	26,008	20,869
Total public	$16,199	$28,593	$29,981
Total private	33,657	7,113	15,493
TOTALS	$49,856	$35,706	$45,474

Cumulative
1937 (51 weeks) $2,393,323
1936 (52 weeks) $2,343,825

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000 other public works $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Cumulative 1936 52 Wks.	1937 51 Wks.
NON-FEDERAL	$942,492	$1,444,011
State & mun. bonds	502,331	518,963
Corporate securities	250,436	516,983
PWA loans, grants	164,727	178,126
RFC loans	24,998	29,939
Fed. aid for highways	.....	200,000
FEDERAL	$691,237	$746,223
TOTAL CAPITAL	$1,633,729	$2,190,234

ENR INDEX VALUES

Index Pase	1913	1926
Construction Cost (Dec.)	244.95	117.75
Construction Volume (Nov.)	146	64

Yadkin Dams Investigated

F. P. C. starts investigation whether existing projects should be federally regulated

Five hydro-electric projects on the Yadkin River in North Carolina are to be investigated to determine whether they are affecting navigation. The Federal Power Commission, on Dec. 17, began an investigation of the projects to determine whether "an order appropriate, expedient and in the public interest should issue to conserve and utilize the navigation and water power resources of [the] region."

Three of the five projects effected are owned by the Carolina Aluminum Co.: the High Rock project, the Narrows project, and the Yadkin Falls project. The other two, the Blewett project and the Tillery project, are owned by the Carolina Power & Light Company.

These five projects were brought to the attention of the Federal Power Commission in connection with hearings held by the Commission in connection with the Tuckertown project of the Carolina Aluminum Co. on the Yadkin River. The Commission recently held that this proposed project would affect navigation of the Peedee River in South Carolina and that a license must be obtained (*ENR*, Nov. 25, 1937, p. 841). All of the five dams involved in the present investigation are downstream from the Tuckertown project except the High Rock dam.

The order as issued by the Commission sets forth that the Yadkin River is a stream over which Congress has jurisdiction and that the occupancy of the river by the five projects affects the conservation and utilization of the navigation and water power resources of the Yadkin-Peedee River region. An investigation is therefore ordered.

• • •

Seattle Will Patent Ruby Dam Design

Seeking to forestall a threatened lawsuit for alleged infringement of patents in the design of the Ruby Dam of the Seattle power system, the Board of Public Works of the city has authorized the city lighting department to take steps to secure patents on the design of Ruby Dam. Lars C. Jorgensen has claimed that the design of the dam is based upon the constant angle arch dam principle which he invented.

J. D. Ross, Seattle lighting superintendent, denies Mr. Jorgensen's contention and asserts that the Ruby Dam design was worked out by the lighting department's own engineers. He says that the Ruby Dam is no closer to the constant angle arch type than are Boulder and several other government built dams on which no royalties are being paid.

BLOW FROM AUTO WRECKS BRIDGE

COLLISION of an automobile with the truss of a steel bridge across the St. Joseph River near Leonidas, Mich., is blamed by county officials for failure of Bennett's Bridge, above. Passengers in the auto swam ashore after it had plunged twenty feet from the bridge into the river.

Government Absorbs Tax on Ohio Dam

Increased taxes imposed on contractors on the Crooked Creek dam in Pennsylvania after the bids have been opened will be adjusted by an increase in the contract price. The War Department on Dec. 15, added to the specifications for Crooked Creek dam a provision that, "the contract price will be considered to include all federal, state and local taxes imposed prior to the date of opening bids." If any tax except income or undistributed profits tax is imposed or changed after the bid opening and is payable directly by the contractors, "then the contract prices will be increased or decreased accordingly and any amount due or chargeable against the contractor as a result thereof will be adjusted on payment vouchers as separate items."

The U. S. Supreme Court on Dec. 6 upheld the right of states to tax the activities of contractors on federal projects, provided that the taxes are not discriminatory (*ENR*, Dec. 9, 1937, p. 915).

Concrete Pontoon Bridge Approved by Board

Plans for a concrete pontoon bridge across Lake Washington between Seattle and Mercer Island have been tentatively approved by Washington State Highway Director Murrow and a board of consulting engineers appointed to study the project (*ENR*, Sept. 2, 1937, p. 373). Mr. Murrow states, however, that the project will not be started if Congress approves President Roosevelt's proposed curtailment of federal-aid for highways. The bridge could be built with funds raised by the sale of revenue bonds, but federal-aid money would be needed to finance the highway to be built in connection with the bridge.

The bridge is a key structure in a proposed 28-mile four-lane express highway which would reduce the distance between Seattle and eastern Washington by fourteen miles. Other structures involved in the project are a fixed bridge 1,800 ft. long between Mercer Island and the east shore of the lake, a 1,500 ft. tunnel at the Seattle end of the pontoon bridge, and eight overhead crossings and three underpasses to route traffic into the center of Seattle.

The pontoon bridge, estimated to cost $1,500,000, as compared with an estimate of $2,400,000 for a more conventional type of bridge, will consist of a series of concrete pontoons fastened together and anchored to a sunken island. A 200-ft. movable section will consist of either a bascule structure or a floating swing bridge operated by propellers.

McCrory Receives Award In Agriculture

Samuel H. McCrory, chief of the U. S. Bureau of Agricultural Engineering, was notified Dec. 9 that he will be the first recipient of the John Deere gold medal which is to be awarded annually by the American Society of Agricultural Engineers for "distinguished achievements in the application of science and art to the soil." Formal presentation of the medal will be made during the annual meeting of the society next June.

Mr. McCrory, a graduate of the University of Iowa, entered the Department of Agriculture in 1907 as a drainage engineer. He became chief of the division of agricultural engineering, then newly organized in the Bureau of Public Roads, in 1921, and when the division was set up as a bureau of the Department of Agriculture in 1931 he remained at its head.

Among the accomplishments on which the award of the medal to Mr. McCrory was based are: development of methods of surveying and design particularly suited to timber swamp lands; work on the flow of water in open channels; development of snow surveys in western watersheds; and service as a member of the state engineering board which revised the drainage and flood protection plans for the reclamation of the Florida Everglades.

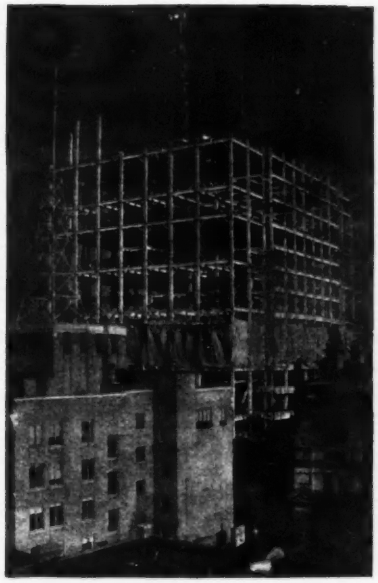
• • •

Mahoning Dam Model Studied at Case School

Model studies of the hydraulic properties of the Mahoning Dam, a major unit in the Pittsburgh flood control project of the U. S. Engineers, will be made at the Case School of Applied Science, it was announced Dec. 9. The Mahoning Dam will be the largest of its type among the nine dams and reservoirs included in the $80,000,000 project. It will be an overflow type of dam of solid concrete construction, about 150 ft. high and 800 ft. long with five gates, each 35 ft. high, on the top of the dam.

Prof. George E. Barnes, head of the civil engineering department at Case, will supervise the tests and experimental work on the model which will cost about $12,000; Professor Barnes will also act as consulting engineer on the design of the dam. Construction work has not started on any of the nine dams as yet, but Tionesta and Crooked Creek dams have been completely designed and are ready for submission to contractors for bids.

Work is to begin at once on construction of the models, of which there are to be four. An enlarged section of the spillway crest and general profile of the dam will be studied to determine the best shape for the rounded top and the best construction for the spillway basin at the foot. An enlarged model of the sluiceway through the dam will be made of transparent material to facilitate study of the flow through this portion of the dam. Conclusions reached with this transparent model will be verified by means of a sectional model of the sluice; a brime solution will be placed in this latter model and a current of electricity passed through it; the path traced by the current will then be compared with the flow lines observed in the previous model. Finally, a model of the complete dam will be tested to coordinate the findings of the previous tests made on the models of details of the dam.



NEW COURTHOUSE IN BOSTON

THIS COURTHOUSE for Suffolk County in Boston will be completed in June of next year at a cost of $5,000,000. Twenty-five stories high, it is divided into 14 main and 11 mezzanine floors. It is 121x158 ft. in plan and 329 ft. high.

The building is of steel frame construction with reinforced concrete floors and foundations. All hoisting is handled electrically for greatest flexibility. Concrete materials are trucked into the ground floor, mixed in a 3 cu.yd. mixer in the basement, hoisted, and distributed in buggies. Salamanders are used to meet winter exposure.

Architects on the project are Desmond and Lord, Boston, and the general contractors are George A. Fuller Co., also of Boston.

Buffalo Bayou Job Is Approved

Army also approves local flood control for Connecticut Valley cities

A report of the Chief of Engineers was forwarded to Congress Dec. 11 recommending improvement of Buffalo Bayou, Texas, and its tributaries above the turning basin of the Houston ship channel. The improvement will provide for flood control, protection of the city of Houston from flood damages, and prevention of deposit of silt in the turning basin of the ship channel.

The project will include construction of detention reservoirs, enlargement and rectification of channels, construction of control works, and any diversions which may be found advisable. The total cost to the United States would not exceed $9,000,000.

The recommendation is conditional on the formation of a local agency which would provide lands and rights-of-way and maintain and operate all works after completion. This agency also must establish and enforce building lines approved by the Secretary of War for the protection of the floodway areas against further encroachments.

Change Connecticut Plans

On the same day the Chief of Engineers recommended that the flood control project in the Connecticut River basin authorized by the flood control act of 1936 be modified to provide for the protection by dikes and related works, of the cities of Hartford and East Hartford, Conn., and of Springfield, West Springfield, Chicopee, Holyoke and Northampton, Mass. The estimated cost of such protection would be $11,524,000, with lands and rights-of-way provided by local interests.

Possibilities for the immediate start of construction on these flood protection works were discussed by President Roosevelt and Secretary of War Woodring at a White House conference held December 17. While the failure of Congress to ratify interstate compacts, due to a controversy over the control of incidental power, has blocked the construction of upstream impounding reservoirs, it is felt that this need not necessarily delay these proposed local works.

The problem is one of obtaining funds. Because the specific projects have not yet been authorized by Congress it is impossible to draw from the regular flood control funds voted the War Department. An earmarking of relief funds offers a possible solution, and it is this that was explored at the recent conference.

New Zoning Uses Are Discussed

Chicago conference hears informal discussion of rural and flood plain zoning

The broadening scope of zoning in such fields as flood-plain control, roadside planning, soil conservation, recreation development, and rural industry, and the importance of zoning in the development of a comprehensive rural land use program, as well as the problems of urban zoning, were discussed at a conference Dec. 13-14 at Chicago. About 250 public officials and others interested in zoning attended the conference, which was called by Secretary of the Interior Ickes and was sponsored by the National Resources Committee.

Frederic A. Delano and Charles E. Merriam, members of the National Resources Committee, presided over the main sessions. No prepared papers were presented, and the meeting was devoted entirely to discussion.

Urban problems

Notes from Jacob L. Crane, Chicago consulting engineer, were presented by P. W. Bourne of the U. S. Housing Authority. They presented the rather startling proposal that when land values in blighted areas are held to be too high, vacant land should be built up and the blight should be allowed to progress to extinction. Housing projects need zoning protection, and zoning should always precede new construction, Mr. Crane held.

Harold S. Buttenheim, editor of *American City*, said that American cities have plenty of room and can gain nothing by overcrowding. He quoted absurd density figures which are permitted by many ill-conceived zoning ordinances. Rational zoning will prevent the inflation of land occupancy as well as of land prices. Some methods of limiting density noted by Mr. Buttenheim are setting requirements for open spaces, limiting floor area or cubage of buildings in relation to the area of lots and limiting rooms or families per acre.

Early ignorance was blamed by Harland Bartholomew, city planning engineer of St. Louis, Mo., for the overzoning which has often resulted in blight, abnormal speculative values, increased cost for street widening, and increased traffic hazards. Standards are now available, he said, to determine how much commercially zoned area or frontage can be absorbed and to guide distribution of such areas, although each city must still be studied separately.

There is not sufficient experience available to justify endorsement of any definite program of flood plain zoning, according to Gilbert White, secretary of the water committee of the National Resources Committee. Flood plain occupancy is the basic cause of all flood damage, but zoning as an instrument to promote the best use of flood plains has not yet been tried widely. New Jersey, Pennsylvania and Washington and a few cities have passed legislation.

The vast amount of non-conforming use of flood plain areas greatly complicates the problem of preventing further occupancies and encroachments and readjusting existing uses, Mr. White said. Flood plain zoning, like rural zoning, is encountering the same lack of standards that cities faced 20 years ago.

Rural zoning

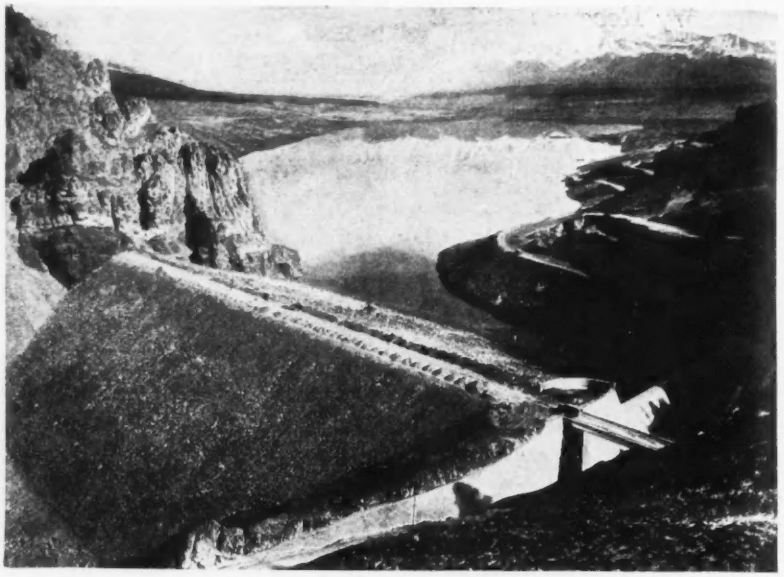
The Department of Agriculture has a well-staffed organization which is relating rural zoning to planning through education and demonstration, a luncheon group was told by E. H. Wiecking, of the office of the department's land use coordinator. The purpose of relocation is to readjust population to take advantage of natural resources. Forest conservation, he said, can do things zoning cannot do. Zoning to protect industry moving to the country is a special problem, and agriculture, recreation and forestry all need thorough analysis.

Roadside and county zoning both fall logically within county jurisdiction, according to J. M. Albers of the Wisconsin State Planning Board. Basic data for a comprehensive plan may sometimes be obtained from aerial maps of state highways, he said. Proper land use can then be assigned, erosion corrected, roadsides zoned for traffic safety, flood plains protected, and property values stabilized.

L. V. Sheridan, city planning engineer of Indianapolis, said that the flood plain problem was largely one of finance, since in many cases costs exceed benefits.

Mr. Bartholomew spoke to a luncheon group on over-zoning of business and commercial areas. Forecasting growth is the problem here, he said. Zoning has protected new developments in the suburbs but has largely failed in the cities because it was undertaken too late. Where commercial and industrial zoning is out of scale with growth of the city, Mr. Bartholomew suggests wider acceptance of zoning to be achieved through education of the citizens. Non-conformists must give way or the area they dominate is doomed to blight.

Zoning can do little to remedy established blight, L. Segoe, city plan consultant of Cincinnati said, but it can aid in preventing blighting of new areas. Exclusion of residences in industrial zones and of industry in resi-



WATER STORAGE BEGINS

TAYLOR PARK DAM, recently completed in western Colorado by the Bureau of Reclamation, begins to back up water behind it; in mid-December 10,000 acre-ft. had been stored. The earthfill dam, which provides additional water supply for the Uncompahgre project, is 168 ft. high and will have a total reservoir capacity of 106,200 acre-ft. The dam will begin its function of regulating the Taylor River next spring.

Acme photo

NEW FRENCH AIRPORT

NEW TERMINUS buildings covering an area 46 times greater than the old structures were dedicated at Le Bourget airport, Paris, last month. The buildings were dedicated in the presence of President LeBrun.

dential zones is needed, since mixed use produces decay. Other aids in combatting blight are tax adjustments, demolition, and rehabilitation.

In closing the conference, Professor Merriam emphasized that zoning is only a means to an end and that it must fit in with the utilization of natural resources to raise the standards of daily living. Standardization and uniformity should not be sought, since such a wide range of varying conditions must be met that no master plan is possible.

• • •

Michigan to Bring Suit To Stop Pollution

Attorney General Starr of Michigan has announced that he will file suit this month in the federal courts to compel the cities of South Bend and Mishawaka, Ind., to stop polluting the St. Joseph River. Several months of negotiation between these two cities in an attempt to settle on a plan of cooperation for the building of sewage disposal plants has been without success.

The Attorney General has taken his action as the result of complaints which he has received from the Michigan cities of Niles, Benton Harbor, and St. Joseph, through all of which the St. Joseph River flows, that industrial plants in the two Indiana cities have made no effort to end pollution. At Niles, where the voters decided to erect a sewage plant a year ago, a movement has grown up to abandon the plan because the Indiana cities upstream are taking no action to clean the river.

Shawneetown To be Rebuilt At New Site

WPA approval of a program for rebuilding Shawneetown, Ill., which was inundated by the Ohio River flood of last winter, on a new site three miles inland was announced Dec. 14. The work will be carried on by means of a WPA grant of $681,000 and a disaster loan corporation fund of $450,000, which will be added to a state appropriation of $150,000 and a $12,000 allocation from motor fuel tax receipts.

Charles R. Lord, assistant state PWA director, will be in complete charge of the project for the WPA.

• • •

Fire in Sewer Tunnel At Montreal

A fire broke out in the compressed air working chamber of the new Trenholme Ave. trunk sewer in the west end of Montreal on Dec. 9. It took seven hours to subdue the flame.

The heading was 800 ft. from the working shaft and carried air at 12 lb.

The blaze is believed to have originated when the flame of a match, lit to test a newly completed section of the excavation for air leaks, was drawn through a leak and ignited straw used for packing.

Sandhogs were assisted in fighting the fire by a group of Montreal firemen. All available hand extinguishers were put in use, since hoses could not be passed through the air locks.

More Money Assigned For Public Housing

Rheinstein, builder and civil engineer, appointed a member of New York City Housing Authority

Further earmarking of federal funds for low-rent housing projects brought the total amount of funds set aside past the $100,000,000 mark and brought to 25 the number of cities for which funds have been earmarked. $33,700,000 has been set aside for the following seven additional cities:

Mobile, Alabama	$1,400,000
Chicago, Illinois	16,000,000
Louisville, Kentucky	4,000,000
Schenectady, New York	1,400,000
Cleveland, Ohio	9,000,000
Scranton, Pennsylvania	1,000,000
Charleston, South Carolina	900,000

The new earmarking raised the total of funds set aside for local housing authorities to $105,300,000. Administrator Straus of the U. S. Housing Authority pointed out last week, when the first allocations were made (*ENR*, Dec. 9, 1937, p. 963) that these earmarkings are subject to revision, inasmuch as they are not based on plans for definite projects but are merely intended to give various cities an idea of what to expect.

Rheinstein appointed

Alfred Rheinstein, New York City building contractor and civil engineer, was appointed to the New York City Housing Authority and also to the post of Commissioner of Housing of New York City. At the same time Edward F. McGrady, former Assistant Secretary of Labor, was also named as a member of the Authority. Mr. Rheinstein's position of Commissioner of Housing corresponds under the new charter to the tenement house commissionership now held by Langdon W. Post. Mr. Post resigned from the authority last week (*ENR*, Dec. 16, 1937, p. 996).

Mr. Rheinstein is president of the Rheinstein Construction Co. of New York City. He is a graduate of Princeton University with a civil engineering degree, class of 1911. He has been in the construction business in New York City since 1914.

• • •

Movie Shows Building Of Gate Bridge

"Building the Golden Gate Bridge," a sound motion picture showing all phases of the work from start to finish, has been produced by the Bethlehem Steel Company. The film is to be released to engineering clubs, universities and high schools.

Many Bridges Damaged In California

Report of Alturas dam failure incorrect, but storm last week caused much damage

An investigator from the California State Department of Dams discovered that widespread press reports, which also appeared in *Engineering News-Record* (*ENR*, Dec. 16, 1937, p. 969) of the failure of a dam above Alturas were entirely incorrect. Neither the large earth dam at Alturas nor the small Hatfull Dam failed.

Damage to highways and highway bridges of California during the storm of Dec. 9-12 had not yet been estimated as this issue went to press, but reports indicate, in addition to damage reported last week, complete destruction of many old bridges and severe damage to several of recent construction. Despite record flood stage in the Sacramento River no damage to bridges on that stream had been reported. Tributaries did not fare so well: on Montgomery Creek two spans of a timber bridge went out; approaches to bridges over Mill Creek and Deer Creek (U.S. 99-E) were swept away; on the Feather River half of the Yellow Creek trestle and a 55-ft. concrete girder span at Rock Creek went out as did portions of the trestle at Gray Eagle Creek; on a fork of the Yuba River above Downieville several miles of highway in the canyon were swept away.

Heavy rainfall

Yosemite Valley reported a 12-in. rainfall in one of the worst storms on record. Much of the Valley floor was covered with water. Water stood 4 ft. deep in the Old Village, but the ornamental stone arch bridges in the Valley are believed to be undamaged. Small steel girder bridges in the Valley were overtopped without serious damage, but a small concrete bridge across Cascade Creek was destroyed and the Yosemite Valley railroad lost at least one important bridge across the Merced River below the Valley entrance.

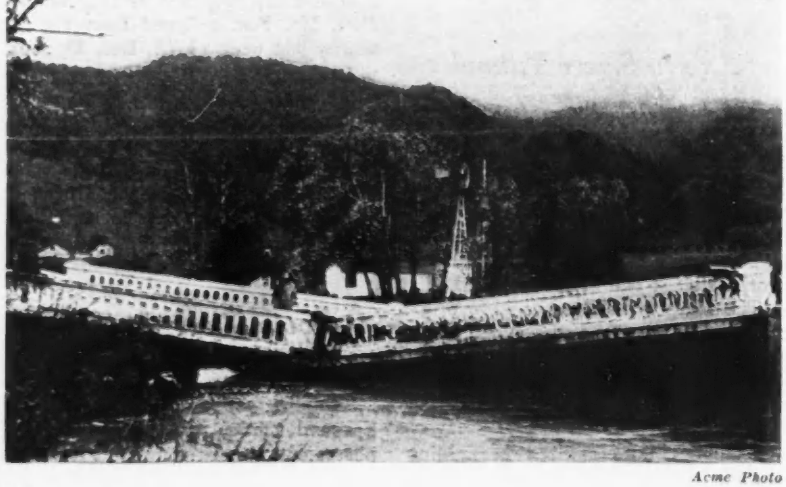
Farther to the South a steel truss on the county road across the San Joaquin River near Auberry was carried out and the Minarets and Western Railroad lost one of its bridges on that stream above Friant. Throughout the path of the storm highways were blockaded by heavy landslides, the washing out of fills and flooding of underpasses. Storm damage extended East of the Sierras into Nevada where several small bridges were swept away.

• • •

Second Tube Under Thames For Blackwall Tunnel

The London County Council has approved construction of a second tube for the Blackwall tunnel under the Thames River, and authorization will be sought from Parliament shortly. The project provides for construction of a vehicle tunnel with a roadway 20 ft. wide to be placed about 800 ft. downstream from the existing Blackwall tunnel. The new tunnel will be used by southbound traffic and the old tunnel by northbound traffic.

The cost of the project, including land acquisition, is about $15,440,000. The British Ministry of Transport has agreed to make a grant of 75 per cent of the net cost of the tunnel and to meet 60 per cent of the cost of the approaches.



Acme Photo

THIS BRIDGE over the Llagan River near Gilroy, Cal. on a main highway, was one of those washed out by the flood which struck northern California during the week end of Dec. 12.

LABOR NOTES

HIGHER WAGE RATES on Grand Coulee Dam than are provided for in the specifications for the new contract (*ENR* Nov. 25, 137, p. 846) have been set in a contract between the Washington State Federation of Labor and the Interior Construction Co., low bidder on the Grand Coulee high dam. The closed shop contract, intended to last for the duration of the construction contract, binds the A. F. L. unions involved to ignore labor troubles; one clause specifies that unions shall "treat as non-existent" any picket lines, whether the picketers are affiliated with the A. F. L. or not. Signed by all international unions of the A. F. L. which are affected by the work at Coulee, the contrast sets up wage scales starting at 75 cents for common labor and ranging to $1.50 for skilled mechanics and $1.65 for shovel runners. This compares with the 60-cent minimum established by the Bureau of Reclamation in the specifications. These rates are substantially those which the A. F. L. asked for at hearings held at the time the wage rates, which it is required in the specifications that contractors pay, were being set.

TWO UNIONS of building trades electrical workers united Dec. 12 when a consolidation agreement was signed by the United Brotherhood of Electrical Workers and the International Brotherhood of Electrical Workers, Local 3, of the A.F.L. The agreement, which has been ratified by the membership of the two bodies, provides that members of the United Brotherhood become members of Local 3 with full rights and privileges. The United Brotherhood is to become a special division of the international with jurisdiction over one- and two-family houses, alterations, commercial maintenance, and industrial electrical work. The United Brotherhood was organized last March through the merger of four previously independent unions.

• • •

Plaque Honors Workmen On Boulder Dam

A bronze plaque 11 ft. wide set in the Arizona cliff of Black Canyon overlooking Boulder Dam was unveiled Dec. 17 as a memorial to the workmen who built the dam and those who were killed during the construction.

News continued on page 1031

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Unnecessary Evil

Sir: Your editorial entitled, "Quiet, Please," in the December 9th issue has proved to be very interesting. This is a subject which should be given much more thought by everyone.

The elimination of noise pays large dividends. This has been proved in office-quieting treatment where an investment in sound-absorbing material on the ceilings has been amortized in from one to two years' time, and then continued to pay dividends of 100 per cent or more each year thereafter. No doubt similar savings can be made in construction work by proper elimination of noise.

No one can work under noisy conditions as efficiently as under quiet ones. This refers to the manual laborer as well as the executive or office type—the only difference being that one seems to benefit more from the quietness than the other—but in all cases the saving in elimination of noise pays tremendous dividends.

Noise is not a necessary evil, and costs too much money.

F. E. BERRY, JR.
F. E. Berry, Jr., & Co., Inc.
Boston, Mass., Dec. 14, 1937

The Young Man's Position

Sir: I do not generally write for publication but at this time I think the younger engineer or prospective engineer should voice a mild objection to the attitude taken by contractors, architects and, as you call them, employer engineers.

Recently while being interviewed for a position I was asked how much experience I had. I outlined my experience, which incidentally was the required type, and was gruffly told it was insufficient, although he did desire a young man.

Now, I am not a college engineer, although I have in the past served practically an apprenticeship to a very superior architect-engineer. I have acquired a remarkable degree of education through my own efforts.

I prefer to think that most of us are being unjustly condemned because we do not have in our possession, due to the past depression, that marked degree of experience.

When, ten years hence, these employers of engineers wish to place a young man in an executive or big position, there is a question of grave importance I wish to have answered. Where will you find them?

N. EDWARD OLCOTT
Oneida, N. Y. Nov 23, 1937

Promoting Appreciation

Sir: We are planning an Engineers' Week in Raleigh from January 23rd to 29th. Although this is the first year we have attempted anything of this character and on this scale at North Carolina State College and object is fairly well defined, namely, to increase the efficiency of the surveyors and engineers and at the same time to develop better social contacts with the professional men of the state.

We are trying, also, to make this a general engineer's week all over the state of North Carolina and are endeavoring to get the Rotary, Kiwanis, Lions, and other civic clubs to devote their meetings that week to the engineering works in their respective communities and to invite some engineer to tell them of these works and their economic and social importance.

If properly planned and sponsored a movement of this character all over the country might react most favorably to the engineering profession. In other words, if once a year we could get the civic clubs to permit some member of our profession to explain to them the importance of the engineering work going on in the various communities, I believe it would do much to create a better understanding and a better appreciation of the engineering profession. Futhermore, it would give an opportunity for a few engineers to get credit for some of their work.

BLAKE R. VAN LEER
Dean of Engineering
Raleigh, N. C., December 2, 1937

How Stiff Is a Beam?

Sir: I have read and studied your question "How Stiff Is a Beam?" (ENR, Sept. 23, 1937, p. 525), and have come to the conclusion that the answer to the relative deflections of such a beam of cast-iron and steel depends inversely on the modulus of elasticity of the two different materials and is only true up to a load that will produce a stress of 9,000 lb. per sq. in. on cast-iron, for up to that stress the modulus of elasticity of cast-iron is practically the same in tension and compression and the neutral axis will coincide with the center of gravity of the section. As soon as the tension stress in cast-iron exceeds 9,000 lb. per sq. in., which will be the case with 500 lb. applied in the center of the section as given in the example, the neutral axis is no longer in the center of the section but shifts more from the center the more the tensile stress exceeds 9,000 lb. per sq. in. A good grade of cast-iron may show a modulus of rupture of 44,000 lb. per sq. in.. and the same bar tested broke at a load of 27,000 lb. per sq. in (Boyd's "Strength of Materials", 3rd ed., Appendix C, cast-iron beams, p. 415).

As this particular beam is fixed at the ends and as the load is such that it might rupture the cast-iron beam, the neutral axis at midspan is above the center of the section and at the ends it is below the center of the section. At some points the neutral axis is in the center of the section.

However, when the stress does not exceed 9,000 lb. per sq. in. then the steel and castiron beams will deflect inversely as their modulus of elasticity. If steel has a modulus of 29,000,000 lb. per sq. in. and a good grade of cast-iron 19,000,000, then the cast-iron beam will deflect 1.53 times as much as the steel beam will deflect.

Some texts give common cast-iron a modulus of elasticity of 12,000,000 lb. per sq. in.; such iron for stresses up to 9,000 lb. per sq. in. will deflect 2.42 times as much as the steel beam. For higher stresses actual tests of the two beams must be used to answer the question.

A. W. FISCHER
Veterans Administration
Washington, D. C., December 13, 1937

ENGINEERING NEWS-RECORD

Copyright 1937, by McGraw-Hill Publishing Company, Inc.

Volume 119, Number 26

Editor, F. E. SCHMITT · *Editorial Staff*, V. T. BOUGHTON
N. A. BOWERS, W. G. BOWMAN, W. W. DE BERARD
C. S. HILL, H. W. RICHARDSON, E. J. CLEARY

Editorial Offices at 330 West 42nd Street, New York

DECEMBER 23, 1937

TEN YEARS AGO last month in New York City huge fans started to whirl in strange looking buildings facing one another across the Hudson River, while below, in tubes lying in the river-bottom silt, an endless caravan of motor traffic began a historic trek. The Holland Tunnel, first mechanically-ventilated subaqueous vehicle tunnel, started its amazingly successful career. Detroit, Oakland, Boston and far-off Antwerp in a few short years emulated this pioneer structure, and now it is New York's turn again. At 4 a.m. on Dec. 22, the Lincoln Tunnel, 2½ miles upriver from the Holland Tunnel, its alignment identified by the same type ventilation buildings, but strange no more, went into service. And as traffic rolls through its single tube, engineers are busy driving a duplicate artery beside it, sure that the press of traffic will fill that tube also. The close observer will notice how few changes in design or appearance have been made from the example set by the Holland Tunnel. What will be impressive are the extensive and expensive approaches. Traffic will not, cannot beat a path to the door of these great river crossings. The path must be provided, sometimes at a cost approaching that of the main structure itself. The designers of the Lincoln Tunnel, finding the example set by the Holland Tunnel almost beyond improvement, followed it closely. But noting a vulnerable spot in the approaches they boldly set new precedent here. In such manner is the practice of engineering kept ever alive and progressive.

Shawneetown Moves

SHAWNEETOWN has had enough of the grim spectre of floods. Citizens of this oldest river town in Illinois have decided to pull up their roots, abandon their homes and places of business and retreat to the security of the nearby hills. No more will swirling waters engulf their habitations—a vivid, bitter experience of only a few months ago. Scores of other communities could follow Shawneetown's example, but they probably won't do it voluntarily, for home ties are strong and they cling hopefully to the fallacious belief that floods won't come again. Yet the possibility of clearing the flood plain cannot be overlooked in making plans for flood control. Storage and regulating reservoirs will help, but they are wholly inadequate for control of a great basin like the Ohio. Local protection works are of some use, but again they are inadequate in most cases unless cost is raised beyond all reason. We must give greater recognition to the fact that man with his works has encroached upon the river's rights and return all the disputed lands possible to the river, permitting them to be used only for such purposes as would entail little damage in case of submersion. Shawneetown has set the right example.

Small Town Sanitation Service

OUTSTANDING among the smaller sewage disposal plants built this year is the one at Middletown, Conn., which is featured by compactness in design and extensive use of mechanical equipment. As described elsewhere in this issue, disposal efficiency and ease of operation characterize this 3 m.g.d. installation, which provides primary treatment, separate digestion and sludge disposal by incineration. Quite naturally the incorporation of mechanical devices must be predicated on the employment of competent technicians to maintain them. And to assure skilled operation on the limited budgets usually reserved for small plants, the Middletown plant has been located adjacent to the new municipal refuse incinerator so that both sanitation services could be supervised by a single staff, properly qualified. Such a dual arrangement permits economy in operation while achieving the higher efficiency gained by the use and expert application of the latest aids in disposal practice.

Asphalt Research

COORDINATION OF RESEARCH into the properties and uses of asphalt as a road material, now being conducted by many scattered agencies, was urged by Thomas H. MacDonald at the National Asphalt Conference held recently in Memphis. Mr. MacDonald also expressed the belief that the oil companies should provide funds necessary to make this coordination possible and to permit the Highway Research Board to lay down a program of additional study to fill in the gaps that now exist in the knowledge of the properties of asphalts. The need for such a planned research program was very apparent at the conference. Almost every state finds itself faced with unanswered questions, some of which have been answered satisfactorily elsewhere while others have not been solved by a program of study that appeared logical. Thus much work is duplicated needlessly. Further, all studies of the use of asphalts are greatly complicated by the unnecessarily wide range in qualities of supposedly similar products. Here then is a

field of research by both users and producers that has vast possibilities in improving roadbuilding.

Icy Pavements

HIGHWAY MAINTENANCE finds its most troublesome problem in icy pavements. Ice is a hazard that occurs suddenly over large mileages of road. Remedial measures cannot successfully be applied piecemeal, but area attack has to be made on a general danger. This calls for preparedness and wide and fast mobilization of maintenance forces. As forcibly presented by Commissioner Van Wagoner in this issue, the defense and attack is summed up in organization and equipment for immediate action. And the weapons available are not too effective. Neither the thin ice of the sleet storm nor the thicker coating of half-melted wheel compacted snow can be removed successfully by mechanical means. About all that can be done is to coat the glare surface with sand. But sanding without thawing agents does not last, and the available thawing agents may prove destructive unless carefully used. In all it is critically important to realize quickly that the icy road is a problem striking deeply into maintenance organization and even into preventative design and construction.

Empirebuilding

WHEN WORK BEGINS on the high dam at Grand Coulee, under the bids just taken, it will mark the first decisive step toward developing an agricultural empire from the vast tract of desert known as the Columbia Basin. The greatest irrigation enterprise of all time is thus initiated. Something of its size and character may be gleaned from these items: A cost of three hundred million dollars added to the sixty-odd million spent in building the foundation on which a dam some three hundred feet high is now to be erected, a huge high-level storage reservoir, a pumping plant to lift a substantial river a height of several hundred feet, a canal network of corresponding magnitude, and nearly one and one-quarter million acres of irrigated farmland.

Thus the country enters on a colonization project that will create a new province more than twice as large as the southwestern agricultural empire that came into existence when the Colorado desert became the Imperial Valley. Columbia Basin is not the only current development of new irrigated land; it is but part of a reclamation program of unprecedented magnitude now being carried out. Reclamation projects already under construction will water more than 3,000,000 new acres.

Why this development of new irrigation empires? In brief, for three reasons: to build up the sparsely populated western mountain and desert country into a stronger economic unit; to make the most precious resource of that region, its remaining unused waters, useful to man; and to provide farm opportunities for those western settlers whom the hopelessness of farming the submarginal lands of the Great Plains drives to the irrigated areas. It is practical empirebuilding, entitled to high rank in the human scale of values.

Let us look at the cost involved, however. It is quite important to do this, for the taxpayers of the nation must foot the bill. Is the work proceeding at reasonable pace, within the means that the taxpayer can properly devote to such development purposes? An answer may be found in comparison of predepression expenditures on reclamation with those of today.

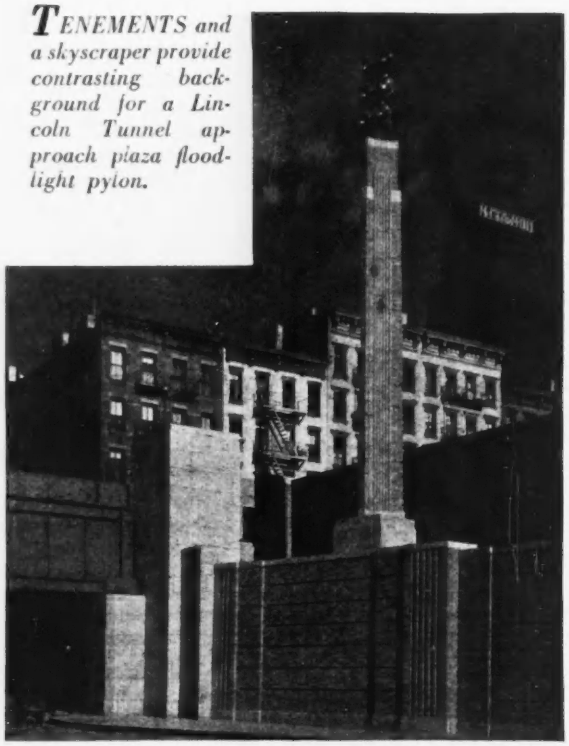
Up to four or five years ago, when large emergency funds were allocated to federal reclamation, it had gone on for thirty years on the basis of an annual expenditure of some seven million dollars, the amount received from certain sources earmarked for reclamation use. Since then emergency moneys and special appropriations have multiplied on the reclamation budget, and present expenditures are nine or ten times as large. Undertakings whose total cost will exceed 600 million dollars are already in progress, without counting the Columbia Basin in the list. The taxpayer may well feel concerned in contemplating these figures.

The huge local development program represented by reclamation has come into being without express consideration of the program as a whole, or of the due proportion of the rate of spending involved. Demand for carrying on reemployment and recovery activities, rather than definite thought of the future, controlled the operations, while the details of the program were fixed by chance, so to say. New reclamation projects in many instances have been placed on the survey list, planned in detail and pushed forward to construction mainly because some member of Congress wanted them built for his constituents. An over-all program at no time was laid down; no considered planning to fit pocketbook limitations was applied to fix the scope of work.

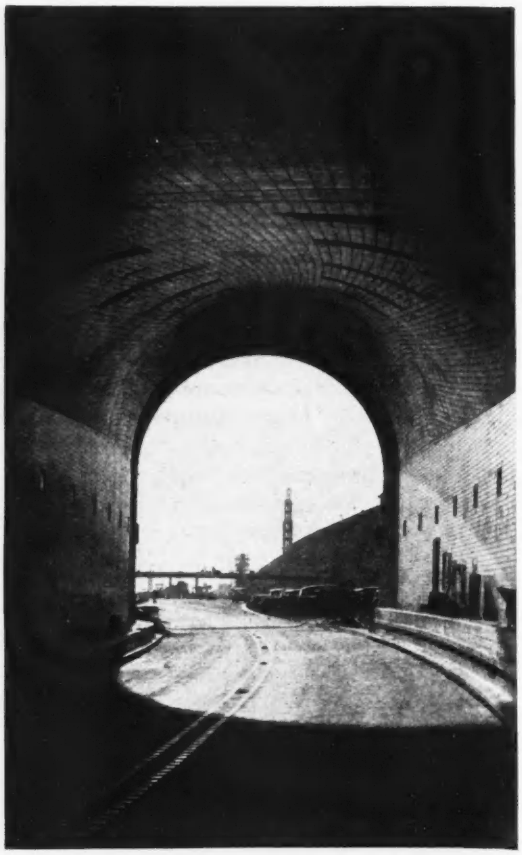
Now that Columbia Basin development is making a start it is time that the task of laying down a definite program, a national policy under which reclamation can go forward soundly, be undertaken. The necessary facts as to river and land resources may not be known with sufficient completeness and definiteness to permit of carrying out this task; if so, Congress should direct that the facts be gathered and studied before a program is drafted. A businesslike program, at once constructive and prudent, is urgently essential if irrigation empire building is to be carried on with wisdom and soundness, in the interests of the nation as a whole.

PICTURES IN THE NEWS

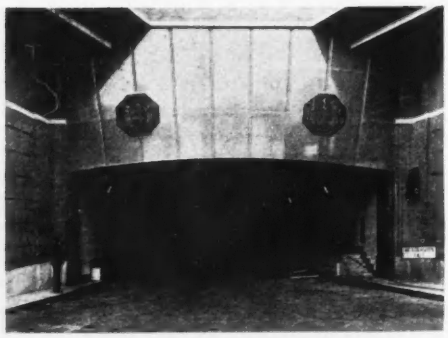
TENEMENTS and a skyscraper provide contrasting background for a Lincoln Tunnel approach plaza floodlight pylon.

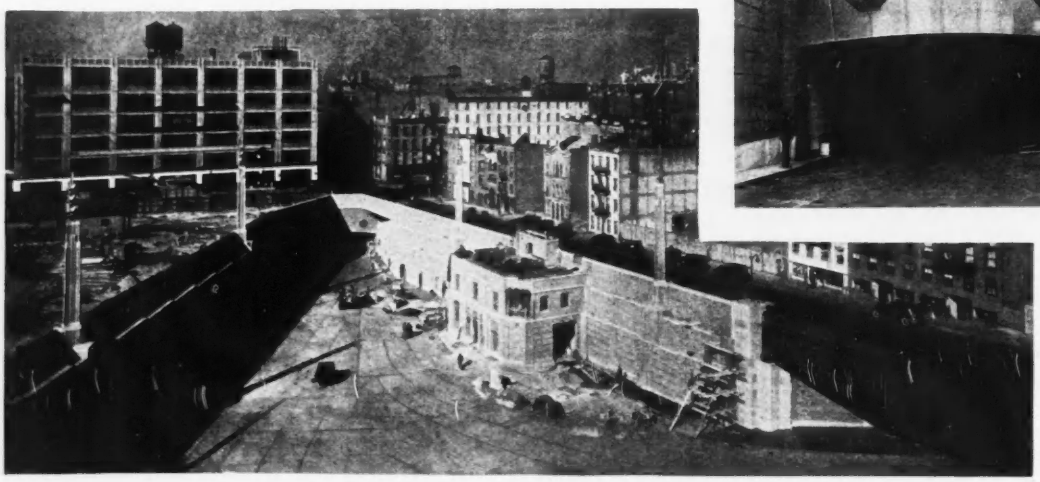


Port of New York Authority Photos



A JOURNEY TO JERSEY through New York's new Lincoln Tunnel under the Hudson River begins below at the approach plaza, which joins traffic from the north (underpass at right) and from the south. The inset is a closeup of the entrance and at right above is daylight in Weehawken, N. J., seen from the south tube, which was opened to traffic December 22.





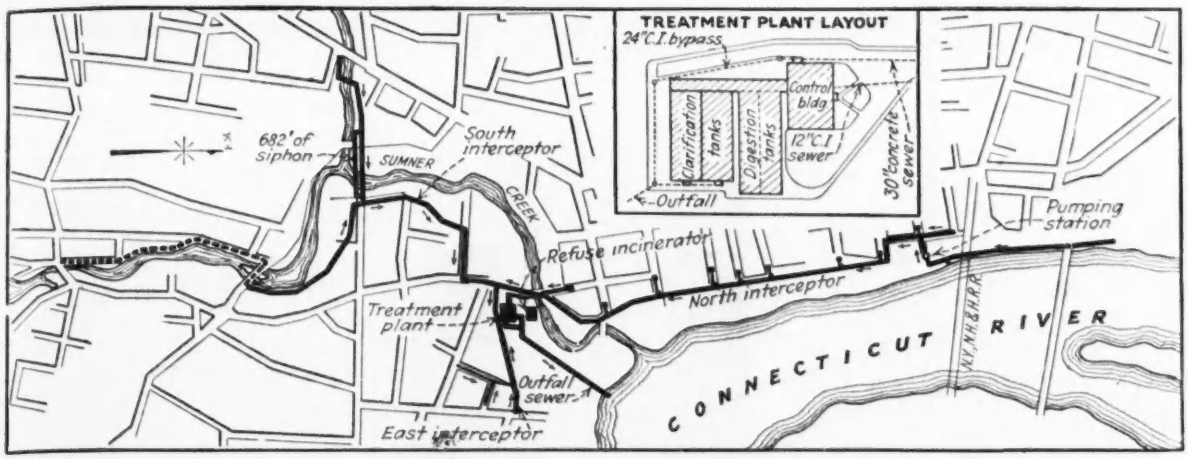


FIG. I. LOCATION PLAN OF INTERCEPTING SEWERS AND GENERAL LAYOUT OF SEWAGE DISPOSAL PLANT

Sewage Disposal at Middletown

by THOMAS F. BOWE
Consulting Engineer, New York

Connecticut community enlarges sewer system and builds a primary disposal plant featuring latest mechanical aids in treatment

MECHANICAL DEVICES play an important role in the sewage treatment plant recently completed at Middletown, Conn. From grit handling to final sludge disposal by incineration, the new plant incorporates many types of new equipment to promote disposal efficiency and ease of operation.

Designed for a flow of 3 m.g.d., the plant provides sedimentation, separate sludge digestion in rectangular tanks, vacuum dewatering, and incineration in a multiple hearth furnace. Improvements made in the sewer system at the same time included the construction of a pumping station and 3.5 mi. of interceptors.

Middletown, with a population of 24,500, is located in the central portion of the state, on the west bank of the Connecticut River, about thirty miles from Long Island Sound. Previous to operation of the present plant, the majority of sewers were discharging their flow without treatment to the Connecticut River or its tributaries, through 16 outlets. A small portion of the sewage is treated by an Imhoff tank installation.

The design of intercepting sewers was prepared to direct most of the city's sewage to the treatment units without pumping. This was complicated by the need of placing pipe lines and plant above normal flood levels of the river. The various outlets were intercepted by three main branch sewers known as the North, South, and East interceptors.

North Interceptor—This is the main sewer paralleling the river and it serves the more developed section of the city wherein combined sewers exist. It is about 7,700 ft. in length, and is routed across Sumner Creek on a two-span steel bridge. Provision was made to by-pass storm flows in excess of maximum hourly sanitary sewage volumes, by the construction of ten regulator chambers.

The regulators consist of an adjustable float and gate arrangement, the gate being of the reverse Taintor type. The float chamber is connected with the interceptor and volume discharges are controlled by the depth of flow in the sewer.

Sewage from the northerly end of the city is directed to the interceptor by a small pumping station. This is equipped with duplicate centrifugal pumps of the vertical type, electrically driven, and with a rated capacity of 750 g.p.m. each, against a total head of 30 ft. Operation of the station is entirely automatic, control being exercised with float switches and automatic alternators.

South Interceptor—This sewer is 10,000 ft. in length, and includes two bridged stream crossings, and a siphon which conveys sewage across a valley. A feature of the siphon design is an arrangement whereby sewage may be drained from the lower siphon chamber to an existing low level sewer.

East Interceptor—This sewer involved the installation of 10,000 ft. of cast iron pipe line across the meadow on wooden pile bents. Subsequently, fill was placed up to and around the pipe. Suitable arrangements were necessary to maintain cross surface drainage from the inland side during low river stages, and toward the inland side at flood stages, since the earthwork was not designed to serve as a dam.

Both steel and cast iron pipe were used on the bridge crossings. The

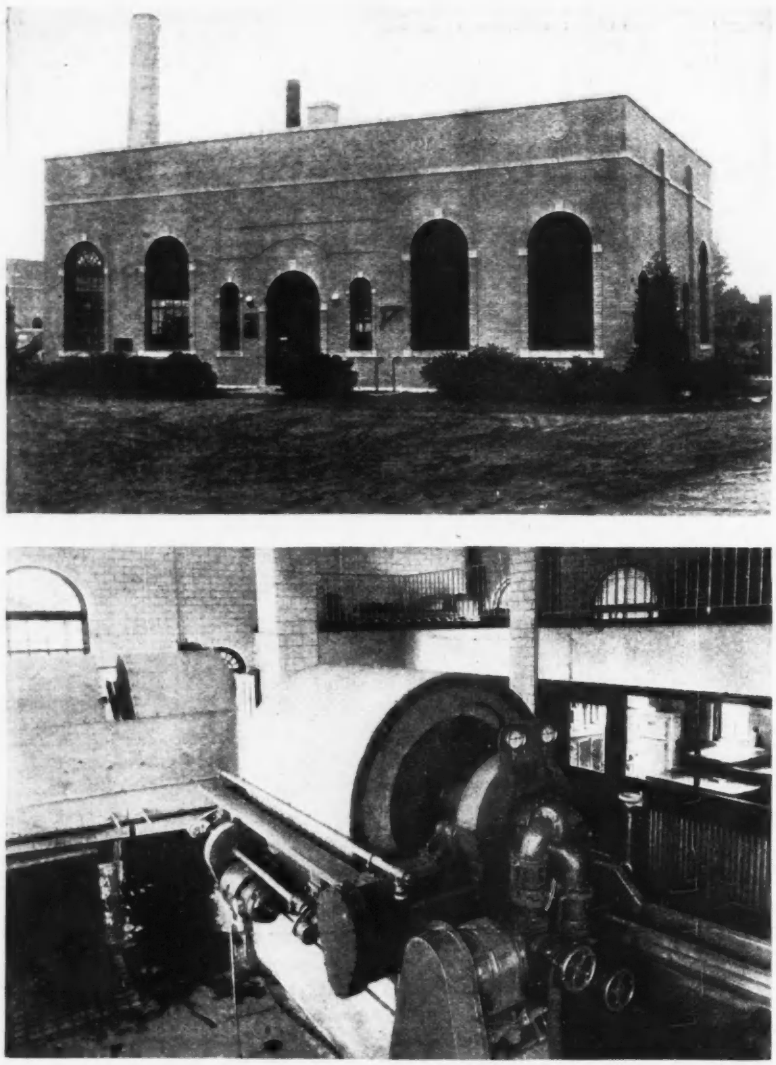


Fig. 2. Housed in the control building (top) is the principal mechanical equipment. The center picture shows the combination grit and screening collectors, vacuum sludge filter, and laboratory facilities. The bottom view shows the filter appurtenances and hot water boilers in the basement.

pipe is supported by piles, which includes half of the outfall line as well as the East interceptor, is of cast iron. The balance of the system is of vitrified and reinforced concrete pipe, the latter being used for sizes 24 in. and larger. Reinforced concrete pipe is surfaced on the interior with a bituminous material.

Pile foundations used

The treatment works are located almost midway between the north and south boundary lines of the city, about 1,100 ft. from the Connecticut River. The site is low-lying meadow land, adjacent to Sumner Creek. Overlying foundation material consists of alluvial deposits of silt, sand, and clay, and it was necessary to support all structures on pile foundations. Cast-in-place concrete piles, driven to an average depth of 33 ft., were used for the plant structure. Timber pile bents were used to support the influent and effluent sewers. Bearing capacities of piles were determined by a continuous driving record on each pile, and by static load tests applied to selected piles.

In addition to their primary duty of load bearing, the piles will also serve to resist hydraulic uplift action, incidental to annual high flood waters. Basement walls and floors of the buildings are designed to withstand water pressures of 26 ft., corresponding to the all-time high flood record in March, 1936.

Treatment plant design

Investigation of Middletown's sewage, and of the river flow and dilution, indicated that primary treatment would suffice. The various units are designed for an anticipated flow in 1946 of 3 m.g.d. This corresponds to a flow of 113 gallons per capita, for an estimated serviced population of 26,500 persons, and includes domestic, commercial, and industrial wastes, as well as a reasonable allowance for infiltration.

Sewage from the interceptors converges at a junction chamber and passes to duplicate mechanically-cleaned combination grit and screen chambers housed in the control building. Adjustable baffles provide for an average velocity through the grit chamber of 1 ft. per sec. The bar racks have clear openings of 1 in.; operation of the rakes and buckets

is automatic and intermittent by means of time relay switches, with settings from 33 sec. to 33 min. Grit and screenings are discharged to a covered inspection chute and, after sorting, are directed to the sludge incinerator by means of a belt conveyor. This conveyor is also used for transporting sludge cake which has been filtered.

Following the grit and screen chambers, the sewage flow is directed through a 9x18 in. venturi tube, to either or both of two clarification tanks arranged to operate in parallel. The flow meter, located on the ground floor of the control building, provides a continuous and totalized record of the sewage passing through the plant.

A pipe gallery, extending along the southerly end of the tanks, contains all piping and control valves for delivery of sludge and sewage to and from tanks. Sidewalk-type lights provide adequate illumination for this water-tight chamber, and valves and meter tube can be readily serviced. The vent for gallery is carried above flood levels of the river.

Clarification tanks are of the rectangular longitudinal flow type. Each unit is 75 by 25 ft., with an average water depth of 9 ft.; the detention period is 2 hr., based on design flow. Each tank is equipped with two rows of chain and flight type collectors, which draw the settled solids to the influent end. At this point, cross-collectors are provided to further collect and concentrate the sludge before withdrawal.

The flights are arranged to collect floating matter on their upper return travel. Full width skimming is effected by construction of concrete shoulders at the water line, leaving a minimum of clearance between wall and flights. The scum so collected is placed in a receiving trough, drains to sludge pumps, and is delivered to digestors.

The effluent from the clarifiers is discharged into the river through a 24 in. c.i. outfall sewer.

Rectangular digestion tanks

The digestion tanks are rectangular in shape, 16 ft. wide, 85.25 ft. long, and have a depth of 16 ft. These units, with a combined volume of 41,780 cu.ft., will provide 60 days detention.

Each unit is equipped with all-steel sludge collectors and scum breakers. These consist of channel-shaped cross flights, mounted at 10 ft. intervals on endless chains. Diagonal fins and manganese steel wearing shoes are attached to the flights, the latter sliding on abrasion resisting flats at both the upper and lower runs. The diagonal fins are arranged to move sludge alternately to the left and right as well as forward and, in this manner, thoroughly mix the sludge.

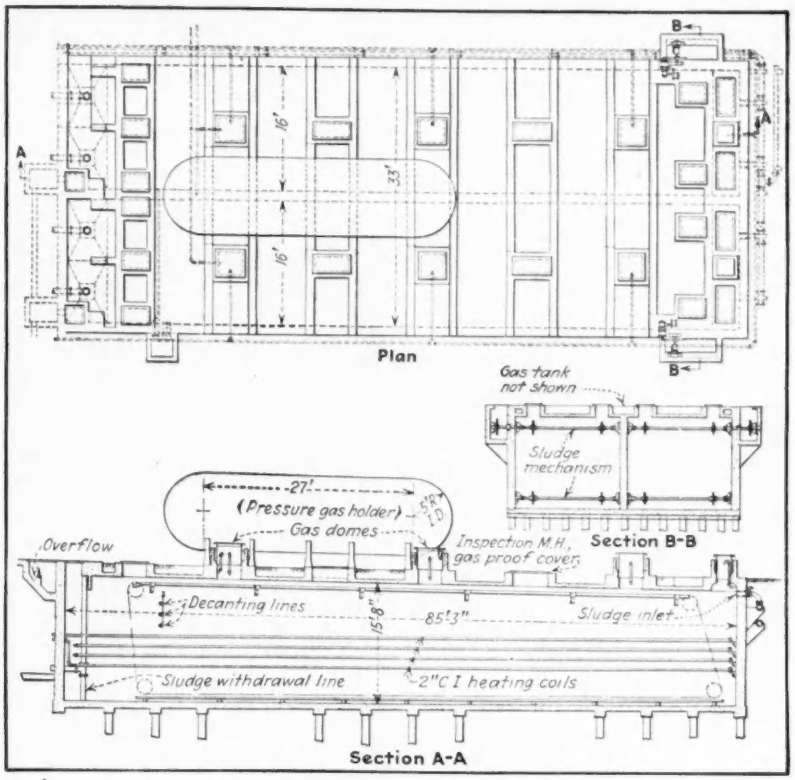


Fig. 3. Design details of rectangular sludge digestion tanks.

Concentrated digested sludge is ultimately deposited in deep hoppers, at the influent end of tanks. The speed of the chains is 2 ft. per min., and equipment is operated about 4 hr. per day. Collector chains are kept taut and free of excess stresses by means of cables, pulleys, and counterweights, mounted above the tanks.

The digestion tanks are equipped with six gas collecting domes, having a 12 in. water seal. To circulate hot water through the digestors for the maintenance of an 83 deg. F. temperature, 2-in. c.i. pipe coils are used; these provide 750 sq.ft. of heating surface. A cylindrical 2,650-cu.ft. steel tank, mounted on top of the digestors, is used to store excess gas under a pressure of 25 lb.

Sludge from the clarification tanks is pumped to the digestion tanks, the pumping being alternated between digestors on successive days. Supernatant liquor is returned to the influent sewage. All tanks and channels containing sludge or sewage are surface-proofed with a bituminous material.

Control building features

All other appurtenances utilized in treating the sewage are housed in the control building, which measures 36x55 ft. in plan. The sludge incinerator occupies a wing of the structure, and is separated from the remainder of the building by a dividing wall. The incinerator is located in the basement, and is charged by a screw conveyor located on the ground floor. Gas apparatus, including flame trap and meter, has been installed adjacent to the incinerator.

Equipment located in the main basement of the building includes two sludge pumps; duplicate sludge conditioning tanks; hot water boiler for digestion tank heating; a steam

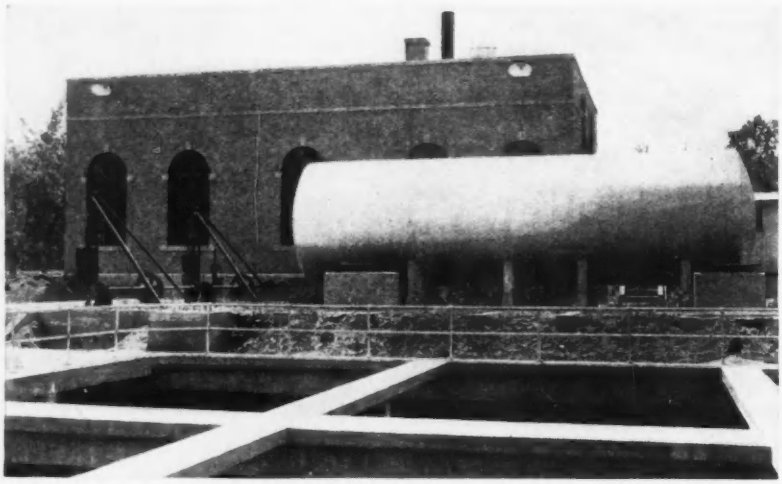


Fig. 4. Gas storage tank with a capacity of 2,650 cu.ft. mounted over the underground digestion tanks. Excess gas will be stored under a pressure of 25 lb.

plant for the building; various appurtenances necessary for the operation of the vacuum filter; and a gas compressor.

The ground floor contains the vacuum filter, with belt conveyor, the grit and screen mechanisms, and the main switchboard panels. Also located on this floor, in steel-glass enclosures, are the office, laboratory, and chemical feed and storage room. A balcony has been constructed above these rooms for storage of equipment and possible chemicals, if it is found advisable to purchase the latter in quantities greater than truckload lots.

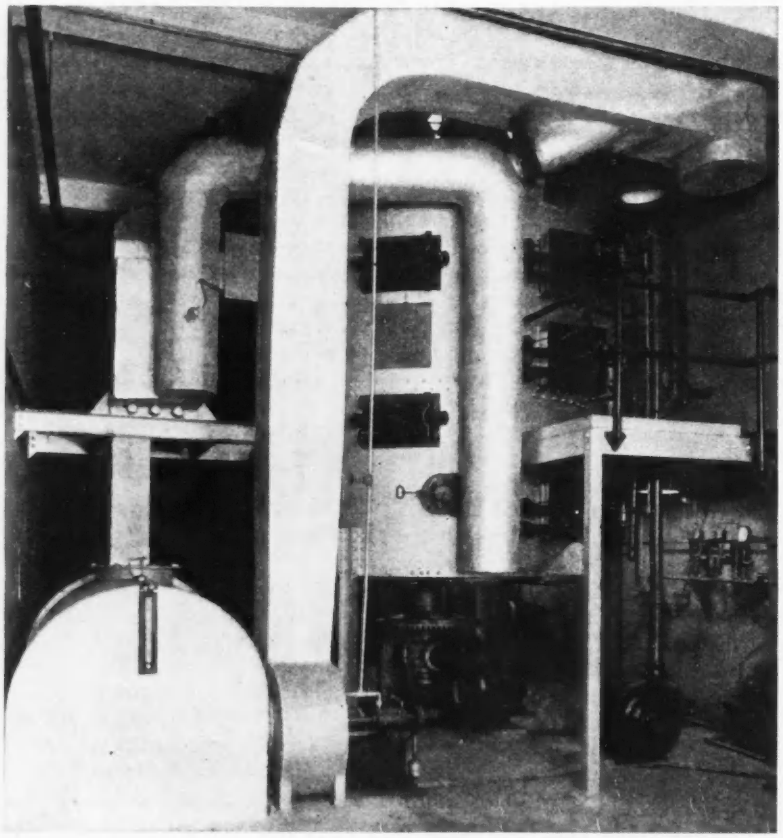


Fig. 5. Sludge incinerator of the multiple hearth type. At the left are the dust collectors and pre-heater.

Located directly under the chemical storage room are the sludge conditioning tanks, where lime and ferric chloride are added. Sludge is conditioned in batches, being mixed with horizontal shaft paddles, and pumped to the filter pan on the ground floor. The vacuum filter is of the continuous rotary drum type, with a net area of 96 sq.ft., and is guaranteed to produce three pounds of solids (dry weight) per square foot of filter area per hour. Filter cake is discharged directly to a belt conveyor; the filtrate liquor is returned to the influent sewage by gravity.

Sludge cake is conveyed by the belt either to the variable speed screw conveyor feeding the incinerator, or to storage piles on the charging room floor when the incinerator is not operating. Although the digested sludge cake is anticipated to be of a uniform nature, the variable speed feature on the screw conveyor provides a convenient control of the rate of feeding to the incinerator, should any variation occur in the moisture or volatile content of the cake.

Multiple-hearth incinerator

The sludge incinerator is of the multiple-hearth type, 9.25 ft. in diameter, with four hearths. It is guaranteed to convert to an inert ash, one ton of dry sewage solids in 8 hr. without creating any smoke or odor nuisance. The guarantee is based on burning a sludge cake containing not in excess of 75 per cent moisture, and with a heat value of 4,000 B.t.u. per lb. of dry solids. Sludge passing through the unit is subjected to a temperature of 1200 deg. F.

Ash discharges at the bottom of the unit, and is elevated by bucket conveyor to an ash hopper, located at the ceiling of the charging room; an enclosed steel chute conveys the ash outside of the building at truck loading height, and is disposed of by filling about the site.

The plant is designed to utilize the combustible gases evolved as a by-product of sludge digestion. Both heating units are provided with duplicate burners, while the sludge incinerator is equipped with combination burners to use either digestor

gas or fuel oil, the latter being for stand-by purposes.

The gas system consists of collection domes in the roof of the digestors, a gas compressor, the gas storage tank, and a flame trap. The compressor is automatically controlled by a mercoid switch, set to start at 4 in. water pressure in the gas domes, and stop when this pressure is reduced to zero inches. The storage tank is provided with pressure relief valve, releasing at a tank pressure of 28 lb. per sq.in. A pressure reducing valve, installed between the storage tank and gas washer, reduces the gas pressure entering the washer and flame trap to 8 in. water pressure. A bypass line permits utilization of the gas directly from the digestion tanks. This line is also used to return gas to the sealed digestors while withdrawing sludge, thereby preventing the formation of a vacuum and breaking of the gas dome seals.

Operating results

While it is yet too early to outline any detailed data on operating results the following comments may be of interest.

The flow through the plant has shown considerable seasonal variation since sewage was admitted in March, 1937. In that month, the flow averaged 2.52 m.g.d.; in April, 2.25; and in May, 1.53 m.g.d. During the summer months of June, July, and August, the flow to the plant has averaged 1.07 m.g.d. Primary treatment has resulted in an average reduction in settleable solids of about 95 per cent, and a reduction of the suspended solids of 50 per cent.

Lime was added to digestors during the first few weeks of operation; thereafter the tanks maintained a pH of 6.9 to 7.1, without further control. Heating water has been circulated through the tank coils for 4 to 6 hr. each day, to maintain tank temperatures of 83 to 85 deg. F. Gasification is proceeding satisfactorily, and it is anticipated on the basis of present conditions, that sufficient gas will be available shortly for all intended purposes.

Results of operation of the vacuum filter have been highly satisfactory. Rates as high as 8 lb. of dry solids per sq.ft. of filter area per hr. have been obtained. Sludge delivered from the digestors has a solids content of 13 to 15 per cent. As previously noted, lime and ferric chloride are employed as coagulating chemicals; 6 to 8 per cent lime, and 2 to 3 per cent ferric chloride have been found suitable for this sludge. When so conditioned, the solids content of the filter cake averages 40 per cent; in no case has it fallen below 35 per cent, and on at least one occasion, it has been as high as 46.5 per cent. The performance test on the incinerator was not completed at the time of this writing.

The design of sewers and treatment works was executed by the writer serving as consulting engineer. Construction was supervised by the personnel of the Department of Public Works of Middletown, Samuel C. Cannon, superintendent, and Richard E. Mylchreest, chairman of the board. The treatment plant was built by the Suburban Engineering Co., New York. The job was financed in part with PWA grant.

Acknowledgment is made to John G. Albertson, the writer's associate, and Charles E. Potts, Jr., of his staff, for assistance in the preparation of this article.

. . .

How Cities Can Strengthen Their Financial Programs

LOCAL GOVERNMENTS that wish to retain autonomy must try to solve their financial problems through their own efforts as much as possible, advises Carl H. Chatters, executive director, Municipal Finance Officers' Association. "The more local governments seek from superior governments," says Mr. Chatters, "the greater will be the domination of the larger units. Asking the Federal government for 'hand-outs' is neither the proper political nor financial way to solve local difficulties."

He outlines this 15-point program for cities anxious to work out their own financial salvation:

1. Get on to the tax rolls on an equitable basis every parcel of real property and every dollar's worth of personal property.

2. Since it is clear that the real estate tax will continue to be the cities' chief revenue source, collect taxes promptly and vigorously, and do not remit, cancel or postpone tax penalties.

3. Curtail tax exemptions as far as legally possible.

4. Work for statutory and constitutional power to classify intangible personal property for tax purposes. This will encourage and permit an honest listing of intangibles.

5. Where local taxes are not a burden, but taxpayers are complaining, try to obtain their cooperation by giving full city information.

6. Develop adequate accounting and budgeting plans so that revenue may be accurately estimated and expenditures controlled.

7. Get complete facts about the community, its actual resources, its ability to pay, and the cost of public services, to compare with cities of like size and character.

8. Make every public utility completely self-supporting.

9. Do not build up fixed charges for debt service of any kind. Before constructing capital improvements such as auditoriums, hospitals and airports, consider the cost of their maintenance as well as the debt incurred, if any.

10. Every time a new state law is proposed making it necessary for cities to spend money, call this to the attention of the legislature and request new revenues to finance the new activity.

11. Demand a portion of the state gasoline tax, without strings to the funds so distributed.

12. Seek from the states a portion of state-collected, locally-shared taxes rather than grants-in-aid. If a state passes a sales tax law, cities should share in the revenue produced.

13. Search out and rigidly enforce every local revenue source now granted in the city charter or the state statutes.

14. Do not lend the public credit for private purposes such as the construction of improvements by special assessment, general revenues, or general bond issues in speculative real estate subdivisions.

15. Have every service performed for a limited group paid for specially and separately by that group.

Montana's Lone Swingbridge

Army engineers devise neat jack-lift and cable swing arrangement for home-made movable railroad span at Fort Peck Dam

ABSENCE of navigable streams has made the construction of movable bridges unnecessary in Montana, but when the need came this past summer for a swing span to clear a channel used temporarily for navigation the result was far from the ordinary and routine type of structure. The state's first and only swing bridge is a clever design employing a ratchet jack lift to engage a set of bearing rollers under a continuous plate girder span, and a tractor pulled cable for turning power. The structure was built by the army engineers at Fort Peck Dam from materials available on the job. Its sole rival in the state is an ancient vertical lift bridge on a Great Northern Railway branch line over the Missouri River near the North Dakota state line.

The bridge became necessary when the engineers suddenly decided to open up a new borrowpit west of the Wiota-Fort Peck railroad tracks where soil investigations had shown a large deposit of excellent material for hydraulic fill. This plan required a dredge cut into the new area that must be kept open for navigation of accessory floating plant. Therefore the railroad had to be moved to pass around the new dredging grounds or a movable bridge had to be built over the channel. Studies showed the latter course to be the cheaper, especially if materials on hand could be used in fabrication of the bridge.

Design of structure

As the bridge will have a life of less than two years, and the openings will be infrequent, estimated at eighteen or twenty per year, the designers eliminated power swing mechanism in favor of a cable swing from shore. The main span is a single-track deck girder 120 ft. long, fabricated from four 60-ft. girders taken from the old railroad bridge along the downstream toe of the dam, now filled in by the rising embankment. The span rests on a center pier and two end piers, all of wood pile construction. (Fig. 1). When closed, its weight rests on all three piers; when necessary to swing the bridge it is lifted clear of the end supports by four 50-ton ratchet jacks and then turned by cables pulled by a tractor on land.

Details of the ingenious lifting arrangement are of interest. Mounted on a timber platform at the top of the trunnion pier is a bearing frame of heavy 27-in. steel beams. In closed position the bridge girders rest on this frame and on bearings on the two end piers. Within the bearing frame, set near the diagonal quarter points, are the four jacking assemblies. Each assembly consists of a 2-in. bearing plate, a jack, a pillow block and an 8-in. roller. The jacks lift the pillow blocks so the rollers bear against a ring bearing plate on the underside of the girders. Thus the span is lifted free of all supports except the four rollers. A king pin holds the bridge to its center, and four keepers attached to the girders ride under the top flanges of the trunnion

Fig. 1. Ingenious swingbridge over a dredge cut is the latest of the variety of construction items at Fort Peck.

bearing frame, which prevents the span from rocking and also limits the jacking height. Details of the jacking and bearing assemblies are shown in Fig. 3.

Two pairs of the 60-ft. plate girders were spliced end to end, 7 ft. apart, and built up into a continuous 120-ft. deck girder span. Flush with the bottom plate of the girders and 3 ft. 3 in. each side of the center were placed two 27-in. cross beams. Framed into these beams are two 10-in. beams carrying 2-in. top and bottom plates, through which was drilled a 6½-in. hole to take the 6-in. king pin. The pin extends down through and is clamped to the flanges of a 27-in. center beam in the lower bearing frame, which are reinforced with wide plates. The span rotates on a 2-in. ring plate, 8 in. wide and 7 ft. 8 in. in outside diameter, fastened to the underside of the plate girder.

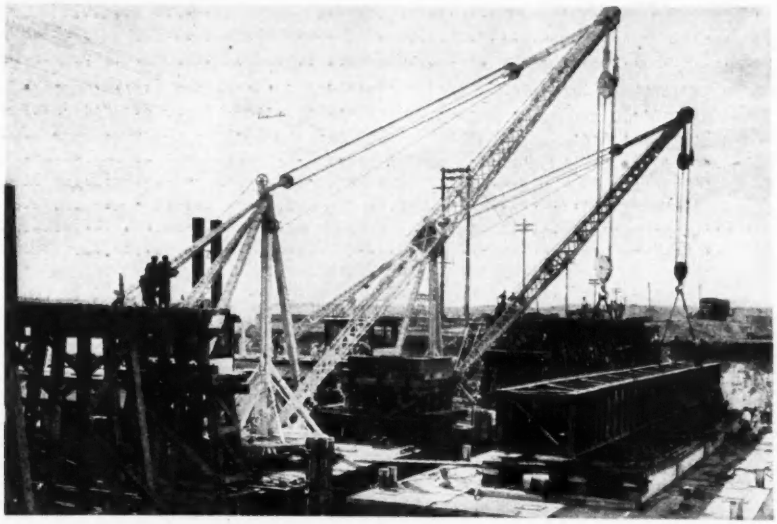


Fig. 3. Twin derricks lift the 120-ft. swing span from its fabrication barge to place on three wooden piers. The lifting jacks set inside the steel bearing frame on the center pier.

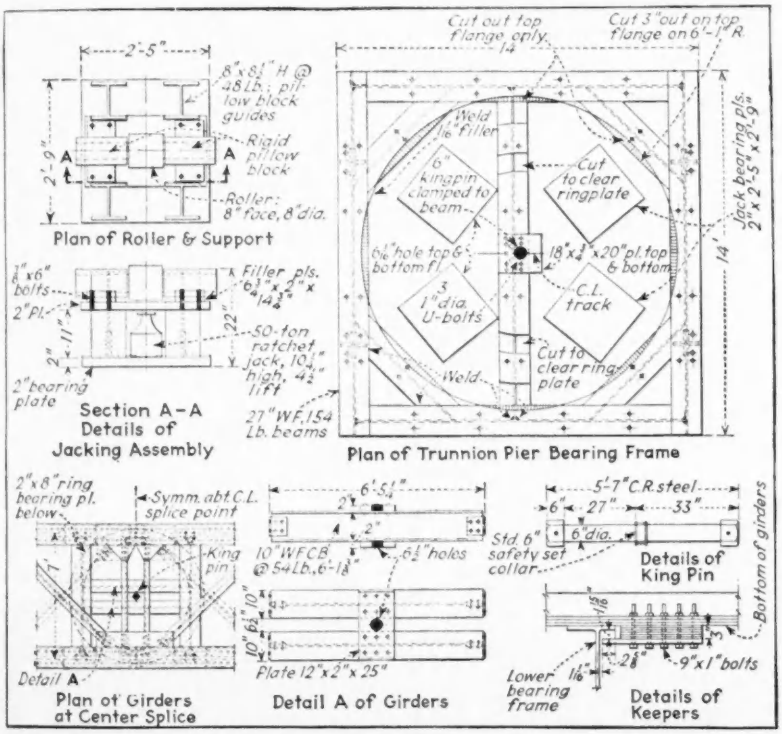

Plan of Roller & Support
Section A–A Details of Jacking Assembly
Plan of Trunnion Pier Bearing Frame
Plan of Girders at Center Splice
Detail A of Girders
Details of King Pin
Details of Keepers

Fig. 3. Details of bearing and jacking assemblies, all home-made from material salvaged from other parts of the project.

Foundations and approaches

The trunnion pier, square in plan, is founded on 25 piles 3 ft. 3 in. center to center, braced with 3x10-in. planks and capped with 14x14-in. timbers 16 ft. long. Over the caps is a 16-ft. square deck of two solid layers of 14x14-in. timbers. This deck carries the steel bearing frame. The end piers are two rows of eight piles each, capped at water line, supporting a double framed bent. The bent carries a solid timber deck protected by a 2x14-in. skid plate 14 ft. long upon which the deck span bears. Pile dolphins at the four corners of the trunnion pier and the channel corners of each end pier cut down the clear span at each side to 45 ft.

At each end of the main span are six pile and frame bent approach spans 15 ft. 3 in. long. The bents are piles below water line, framed timber above. Extending over two spans are double sets of four 9x18-in. timber stringers.

Early plans contemplated the use of the bridge by rail traffic only, but an investigation showed that the structure could be decked over to also carry highway traffic at much less expense than the cost of relocating a county highway that parallels the railroad. Bridge ties 14 ft. long were laid directly on the stringers and girders. Filler blocks 3x8 in. were spiked to the ties, and 3x10-in. planking was laid on top of the fillers. This gives a solid deck 14 ft. wide, with a 12x12-in. timber guard rail and a wooden railing on each side.

Except for some of the piles and hardware, the bridge was fabricated from materials salvaged from other parts of the project. The first step in construction was to bypass the railroad and highway around the site of the bridge. Then a dredge cut 18 ft. wide and 15 ft. deep was made from the river to just beyond the bridge location. Piles were driven and timber was erected by both land and floating plant.

The girders were fabricated into the 12-ft. span on a long barge and floated to the site. Here two of the large floating derricks used for mak-

ing pump changes on the dredges, backed into the two channel openings, easily lifted the span from the barge to its position on the piers (Fig. 2). The bridge was ready for service on Aug. 16, five weeks after start of dredging the cut and only two weeks after start of pile driving.

Operation

The jacks, which are run by four men, working in unison, lift the span clear of the fixed center and end supports. Two cables, one at each end of the swing span, run through sheaves anchored on shore and thence each to a 20-hp. tractor. One pulls the span open; the other backs up, keeping a taut line to steady the span. Reverse operations are utilized to close the span.

The design and construction were carried out by government forces under the general direction of Major Clark Kittrell, U. S. District Engineer in charge of the Fort Peck project. All lifting mechanisms, except the jacks, were machined and built in the project shops.

Servicing Grout Pumps

by A. W. Simonds and V. L. Minear
U. S. Bureau of Reclamation, Denver, Colo.

Slush pumps call for close checking for reasonable efficiency in pressure grouting service

In placing some 750,000 cu.ft. of cement in pressure grouting six western dams, a definite need has been shown to check up pump accuracy and to change details. The work done was grouting foundations and contraction joints. Failures in equipment led to changes and checks designed to reduce delays and stops that often mean the loss perhaps of a drill hole or the plugging of a piping system.

Pumps are preferable

A grouting plant generally consists of a grout mixer, a mechanically agitated sump, a pump or pneumatic injector, and suitable pipe, hose, valves, meters and gages, all of which must be flexible and dependable. The pump or injector is perhaps the most important item of the entire plant. In general the pump is preferable to the injector, and many specifications prohibit placement by any other method.

The pneumatic injector has certain advantages in special cases, as in grouting a cavernous formation, or when large flows of water are encountered and a sanded mix is to be used. The undesirability of passing a sanded mix through pumps is obvious, but if a neat-cement grout is to be used, pumps are superior to the injector in most respects. They need the exacting requirements of high-pressure grouting admirably.

When injection is first begun on the average hole, grout can be introduced rapidly since there is little resistance, but as the hole is filled the resistance, or back pressure, increases until it refuses to accept grout at the maximum pressure which can be safely applied without rock displacement. The pump meets this wide range of requirements by a variation in speed, pumping rapidly when the hole is first begun and gradually decreasing in speed as the hole is filled until it finally stalls when the maximum allowable pressure is reached.

It is not unusual for a properly equipped and operated pump to function steadily under the most trying conditions for several days where failure for even a few minutes would result in a considerable financial loss. Furthermore, since the grout flow is under constant control, grouting at even extremely high pressures with pumps is much safer than when pneumatic placement methods are used.

But so far as is known by the writers there is no grout pump on the market which will stand up and give satisfactory service when high pressures are used. The so-called slush pump most nearly meets the requirements. In fact, it is only necessary to substitute a special type piston to convert the slush pump into a grout pump which will satisfactorily serve the purpose on jobs where small quantities and low pressures are involved. However, if high or even moderate pressures are to be used, or any considerable quantities are to be injected, rather extensive modifications of the slush pump are necessary to reduce maintenance costs and secure satisfactory results. These modifications are neither costly nor difficult to make, provided a suitable pump is selected.

The pump selected should be a steam-or air-driven, reciprocating duplex slush pump of the long stroke type, having large valve openings and removable valve seats and removable liquid-end liners. It should be of ample capacity and able safely to withstand the greatest pressure required. The valves, ports, glands and liners should be readily accessible for quick replacement or repair. Such pumps can be purchased in various sizes and capacities, ranging from 20 to 100 gal. per minute when supplied with air at 100 lb. per sq. in.

Before using a pump for grout injection, it should be checked with regard to valves, cylinder liners, pistons, packing and piston rods to avoid future trouble.

Valves and liners

The pump should be equipped with medium hard, pure rubber valve inserts. Hard valves are satisfactory for very low pressures, but if high or even moderate pressures are to be used they are practically worthless. Balata, which is ordinarily used in pump valves of this type is hard and unyielding, and when a particle comes to rest between the valve and the seat, the valve does not seat properly and a thin stream of grout is allowed to pass between the valve and the seat. The grout is very abrasive, especially at high velocity, and in a short time, a "worm hole" is cut into the seat and the pump will not operate satisfactorily until the seat is replaced. The replacement of a seat is costly, but a valve insert is cheaply and quickly replaced. Seat replacement is rarely necessary when rubber valves are used. Foreign matter such

as pieces of wire, hardened grout from the mixer or metallic fragments which some cements contain becomes embedded in the soft rubber and do not prevent the valve from seating.

Upon receipt of a new pump the liners should be removed and inspected. If they are made of cast metal and high pressure is to be used, they will be short lived and provisions should be made for replacement.

One of the most satisfactory liners which will last almost indefinitely contains a highly polished case hardened steel sleeve as a wearing surface. Before replacing the liner, a gasket should be cut from a good sheet packing made of cork to fit between the shoulder of the liner and the block. Sheet rubber packing should under no circumstances be used. With certain types of liners it is also advisable to replace the soft rubber sleeve which surrounds them with several courses of hydraulic packing and to paint this with white lead or a mixture of grease and graphite. Unless there is a tight fit between the liner and the block, grout will be forced between the liner and the block on the return stroke of the piston, and an action similar to that already described when balata valves are used takes place, destroying the seat for the liner. It then becomes necessary to make extensive repairs upon the pump itself, which usually requires boring out the recess and fitting a machined ring therein to replace the removed metal. This is a costly procedure. Building up the seat by welding is not recommended without preheating the block.

Should grease liner

Before the pump is placed in service, the outside surface of the liner should be thoroughly greased with a good grade of waterproof grease to facilitate future removal when necessary. If not greased, the removal of the cylinder liner may be extremely difficult due to the liner being "grouted in" the block. It is also advisable to check the liners to make sure that they are truly circular in section. The liners of two pumps recently purchased for contraction joint grouting were found to be as much as .012 in. "out of round." Such defects occasion abnormally high piston wear and tend to shorten the useful life of the liners themselves.

The pistons provided with the ordinary slush pump are not suitable for grouting even at moderate pressures. They should be replaced by pistons made of medium-soft rubber molded onto a steel core in a manner which will permit the composite piston to be fastened to the end of the piston rod. These pistons should be nearly cylindrical in shape and with each end flared or enlarged so as to be compressed when fitted into the cylinder. This hour-glass effect tends to sweep the inner surfaces of the liner clean of grout at each stroke and prevent grout from passing the ends of the pistons. Satisfactory grouting work cannot be done unless the pumps, especially the pistons, liners and valves are kept in first class operating condition. Most specifications require that grouting be continued on a given hole until a definite minimum amount of grout is injected in a specified time, or until the pump stalls at a given pressure. Obviously, with worn pistons or with scored liners, the pump will never stall since slippage makes that impossible.

Piston rods should be checked to see that they are round and not oval. Case-hardened rods are highly desirable, since softer rods soon wear "out of round" and the leakage of grout through the gland is difficult to prevent. These rods should be milled square at the cross-head end to aid their removal. A pipe wrench will not grip case-hardened surfaces readily and tends to damage the rod.

Chevron type packing has given very satisfactory service for the liquid-end rods and steam packing for the air-end rods. Sheet packing made of cork from 1/16 to 1/8 in. thick should be used for gaskets for liners and cover plates.

When compressed air is used for power, mechanically operated lubricators of 2 qt. capacity, single-compartment, single-feed type will be found advantageous. In addition, there should be drip oilers to keep rods of the liquid end lubricated.

Notes on operation

Pumps for handling grout must be given the closest attention. When pumping into a hole that requires several hours to fill, the valves often become fouled with partly-set grout and the passages greatly restricted or obstructed altogether. Improper operation may make it necessary to tear down the pumps as often as once a shift and chip out the hardened grout. Complete shut-downs usually result in the contractor's being required to redrill questionable holes at his own expense and therefore should be prevented, if possible. Consequently, on large dams, where deep holes are required, the contractor finds it profitable to provide a standby pump. However, on small jobs, with experienced personnel, a standby pump may not be necessary, as an experienced pumpman can tell if operation is satisfactory from the sound of the pump's exhaust and its behavior.

Flushing reduces delays

Delays are avoided by minor repairs and adjustments between operations. If water is circulated to the full capacity of the pump for about a minute, at the proper time, inert grout can be flushed out before it hardens and the dismantling of pump and chipping out of hardened grout reduced to a minimum. The necessity for occasional chipping and removal of cement cannot be eliminated, even with the best of care. There are on the market various chemical compounds reported to be very effective in dissolving hardened cement and making easy its removal from inaccessible parts of the pump where chipping is most difficult. Cemented liners are most easily removed in many cases by use of a "liner pusher." This is merely a liquid-end piston rod which has been cut off to the proper length to push against a cross-piece which is held against the end of the liner.

The data given are based upon the experience gained by the writers in grouting the foundations and contraction joints on six western dams, built or being built by the U. S. Bureau of Reclamation. John C. Page is Commissioner, with headquarters in Washington, D. C. All engineering and construction work of the Bureau is under the supervision of the Denver office. R. F. Walter is Chief Engineer; S. O. Harper, Assistant Chief Engineer, and J. L. Savage, Chief Designing Engineer. A. W. Simonds is in charge of contraction joint grouting for the Bureau, and V. L. Minear of foundation and tunnel grouting working out of the Denver office under direction of K. B. Kennes.

Removing Ice From Roads

by Murray D. Van Wagoner
Michigan State Highway Commissioner, Lansing, Mich.

Trucks with scrapers and a home-made device for spreading treated sand keep Michigan roads free from ice

Michigan's great ice belt offers a mighty challenge to a state highway department committed to a program of keeping the trunk-line roads open and safe for high-speed traffic 365 days a year. As in other states, winter maintenance in Michigan is broadly classified under the general heading of snow-removal. But from the Bay City line south to the Indiana-Ohio border, the most serious problem is to keep the roads free of ice.

Formerly, the state highway department was content to discharge this responsibility to the automobile public only at hills, curves, dips, intersections, or other obvious danger spots along the highway. A new policy was inaugurated, however, in 1935 of treating roads, not alone at these points, but also at straightaway sections along the highway. The public now expects and demands this service in Michigan.

There are two principal reasons for icy highways. In the first place, wet snow sticks to the pavements and becomes compacted by the passing traffic. This compaction forms a crust which, if allowed to remain on the roadway, turns to ice by repeated thawing and freezing. Ice also forms if this crust remains when the snow turns to rain. Secondly, much of Michigan's ice belt experiences frequent sleet storms during the winter, coating the pavements with a sheet of ice.

To combat the first cause, maintenance men get their equipment out on the roads as soon as the snow starts falling in an attempt to keep it from compacting. This is done by the use of such equipment as clean-up plows, the cutting edge of which can be lowered to the pavements, or with tractor graders or under-truck scrapers. The scrapers are very effective in removing the snow crust and in scraping slush off the pavement before it freezes. The springs on the scrapers allow the blade to pass over projections on the pavement which might otherwise wreck it. A large number of trucks are already equipped with such scrapers for summer maintenance on gravel roads. The only change that is necessary, to use these drags for removing crust and slush is to replace the straight moldboard with a curved one.

Trucks haul home-made spreaders that keep Michigan's icy roads well sanded

In the purchase of trucks the specifications require sufficient clearance under the frame to permit this equipment to be mounted and kept on at all times. They also require the frame and front springs to be strong enough to carry the added load of a plow mounted on the front end of the frame, to eliminate the necessity for braces to the rear axle of the truck which would prevent the simultaneous use of the plow and drag. Thus, the need for tractor graders used exclusively for winter maintenance is eliminated in favor of the truck and scraper operating at faster speeds and also used in summer maintenance.

In the second case, when ice is formed during a sleet storm, the job of removing it is much more difficult. We have found chlorided sand to be the most effective agent available at this time. Its effective application is dependent upon organization and equipment. The county maintenance superintendent is required to have a well-defined plan for obtaining road condition information on a 24-hr. basis. The men working under him are subject to call on the same basis and the superintendent must develop a system whereby these men are quickly summoned to work.

Sand for ice treatment should include

a large percentage of coarse particles smaller than ¼ in. and it should contain no stones large enough to damage automobiles when picked up and thrown by passing traffic. This sand is stocked during the fall months at the garages and along the highways. Calcium chloride to prevent freezing is added at the rate of 50 lb. per cu.yd. It is important that the sand be free from lumps so that it does not clog the spreaders or the lumps strike passing automobiles. When the sand is applied and does not imbed itself in the ice and is blown off the highway by passing traffic, more chloride is added. On concrete pavements this addition must not exceed 50 lb. per cu.yd.

To spread the sand on the highways, the Michigan State Highway Department has built a large number of sand spreaders by using the rear axles of old cars and mounting a disk on the short drive shaft which is turned up to a vertical position. A hopper is installed over this disk and the sand is shoveled from the trucks into the hopper by two men as the truck moves forward pulling the spreader. The disk is rotated by the wheels running on the pavement. This type of spreader costs from $45 to $60 to build.

Within the last year, the spreaders were redesigned so that the truck load of sand was fed directly into the hopper, eliminating the necessity for one man in the operation. The spreaders were also altered so that the spreading has been accelerated and made more uniform.

Grand Coulee High Dam

Plans for completion reveal staggering proportions of world's greatest concrete structure being built on the Columbia River in Washington.

THE GRAND COULEE project on the Columbia River in eastern Washington is a most remarkable and fascinating engineering conception. A combination power, river control and irrigation scheme, it includes the building of the world's most massive concrete structure, one of the country's largest hydroelectric power plants from which part of the power produced will pump water to an irrigation supply reservoir to be created simply by closing off the ends of the Grand Coulee, a mighty hanging valley whose floor is 600 ft. above present river level. Engineering and construction history have been made in the work already done on the project: excavating the foundations, freezing an earth slide, building unprecedented cofferdams, and record speed in placing concrete in the base of the dam. Now plans have been announced and bids opened for completion of the high dam, the building of one of the two power houses and the construction of the pumping plant dam. Development of the irrigation reservoir, canals and distribution system is left to the future.

The bids, opened at Spokane on Dec. 10, indicate that the huge concrete structure will be built by the greatest aggregation of large contracting firms ever assembled on one project. Eleven powerful concerns, including the four now engaged in building the base of the dam, the six that built Boulder Dam, the nearest rival to Grand Coulee in size, and one other have combined to bid $35,000,000 for completing the structure to its ultimate height of 550 ft. and length of 4,500 ft., requiring nearly 6,000,000 cu.yd. of concrete in addition to the 4,500,000 cu.yd. already in place. Only one other bid was received, that from a combination of eight firms for nearly $43,000,000.

Plans for the dam have been revised several times since inception of the project. The contract for the present base originally called for a low dam for power purposes only, contemplating both widening and raising in the future. Fear of failure to establish proper bond between the low and high sections and a bad slide that required excessive excavation led to the decision to change the low dam to the base of the high dam. When this change was made the tentative design of the high dam was announced, but this again has been changed in some detail in the plans just completed.

PREVIOUS ARTICLES ON GRAND COULEE PROJECT

Columbia Basin Project Feasible	June 30, 1932, p. 907
Development Discussed by Engineers	July 14, 1932, p. 52
Initial Construction Operations	Apr. 5, 1934, p. 442
Complete Unit Prices of Low Dam	Oct. 11, 1934, p. 481
Power, Navigation and Irrigation	Nov. 29, 1934, p. 678
Columbia River Project	Nov. 29, 1934, p. 681
Construction Work in Progress	Apr. 18, 1935, p. 574
Aggregate Transportation by Belts	Nov. 14, 1935, p. 674
Excavation and Construction (whole issue)	Aug. 1, 1935
Earth Pressure Tilts Pier of Bridge	Nov. 7, 1935, p. 646
Feeder Grizzly for Conveyors	Dec. 12, 1935, p. 821
Concrete Mixing and Placing	Jan. 23, 1936, p. 119
Aggregate Stockpile Tunnels	June 25, 1936, p. 920
Construction Camp Water Consumption	Sept. 10, 1936, p. 364
Concrete Dispatching System	Sept. 10, 1936, p. 377
Program for Second Cofferdam	Oct. 1, 1936, p. 464
Concrete Improved by Better Control	Oct. 15, 1936, p. 546
Ice Dam Stops Earth Slide	Feb. 11, 1937, p. 211
Ice Dam Stops New Slide	Mar. 18, 1937, p. 404
Cofferdam Leak Checked	Apr. 22, 1937, p. 595
Contractors Win River Battle	July 1, 1937, p. 13
New Concrete Placing Record	July 15, 1937, p. 101
Grand Coulee Cofferdam Removal	Sept. 2, 1937, p. 401

Design features

Briefly, the finished dam will be a straight gravity concrete structure about 4,000 ft. long, flanked at the west (left) end by a smaller gravity dam 500 ft. long meeting the main dam at an angle and housing the irrigation supply pumps. At the center of the main dam will be an overflow spillway 1,650 ft. long, controlled by eleven drum gates each 28 ft. high and 135 ft. long. Surmounting the spillway is a multiple-

arch concrete highway bridge. At either side of the spillway section is a non-overflow section, topped by a highway, and containing the 18-ft. penstocks for the power units.

Outlet works consist of three horizontal tiers of 60 conduits 8½ ft. in diameter, arranged in pairs, twenty to a tier. The tiers differ 100 ft. in elevation. The two upper sets of conduits are controlled by two 102-in. ring seal gates set in tandem in each pipe, and 12 x 12-ft. bulkhead gates at the inlet; the lowest set has one 102-in. ring seal gate and one 102-in. paradox gate in each pipe.

The two power houses are at each end of the dam; one only is to be built now. Ultimately there will be installed eighteen 120,000-k.v.a. generators and three small service station units. In the west power house, which is to be built now, provisions are being made for early installation of three large and two small units.

The pumping plant, located in the flanking dam at the west end of the main dam, will contain twelve pumps, two of which are spare units. Each pump will have a capacity of 1,600 sec.-ft., sufficient for irrigating 120,000 acres, driven by a 65,000-h.p. motor. Intake conduits for the pumps are 14 ft. in diameter.

Even though nearly half the volume of concrete in the dam has been placed, the quantities of work remaining to be done are staggering. In the dam itself 5,500,000 cu.yd. of concrete are yet to be placed, and an additional 350,000 cu.yd. will be required for auxiliary structures. Reinforcing and structural steel, conduit and penstock lining, gates and piping aggregate 44,683 tons of metal. Some 250,000 reinforcing bar intersections in the power house area must be insulated. Metal sealing strips in construction and expansion joints total 80 miles in length. There are 197,000 ft. of drain and grout holes to be drilled and 131,000 ft. of porous drain tile to be placed.

Construction plans

The base of the dam has been completed to roughly El. 940 in the spillway section and to El. 1,000 in the power house sections. Crest of spillway is El. 1,260; top of dam is El. 1,311. Foundations of both power houses are complete, but all of the pumping plant remains to be built. As most of the excavation has been completed the new work is largely manufacture and placement of concrete and installation of conduits, penstocks, gates and piping. Much of the present concrete plant can be utilized on the new work.

The government furnishes all permanent materials and equipment except sand and gravel, which are available at a nearby government-owned deposit. A fabricating plant for penstocks and gate structures will be established by the government at the head of Gand Coulee near the construction railroad. All shop fabrication will be done at this plant by parties other than the general contractor.

The mass concrete cooling system, as used for the base, will be continued in the high dam. Plant already installed is adequate for the cooling.

River diversion for the first part of the new schedule will be through low slots in the spillway section. These slots are merely low block sections, and will be shifted from block to block as concreting progresses, backing up the water. The top of present concrete is about the level of the lowest set of outlet conduits. As the concrete is built up, these conduits will carry part of the river flow. Likewise, the higher outlet works will serve as river diversion facilities when they are installed. Of course, there is always a chance that the entire spillway section might be submerged in a flood.

The contractor has 1,460 calendar days in which to complete the work, subject to a daily penalty of $2,000 for delay beyond the contract time limit. Minimum wage rates, varying from 60c. for unskilled to $1.50 for skilled labor were stipulated. However, the low bidder, the Interior Construction Co., has already announced signing an agreement with A.F. of L. unions that set wage scales at 75c. minimum for unskilled labor and up to $1.65 for equipment operators, and binds the unions to ignore labor trouble of whatever source.

The old contract will be finished shortly after the first of the coming year, but the new construction schedule will be rather slow during 1938.

Chronology of plans

The first investigation of the Columbia Basin project by the federal government was made by the Bureau of Reclamation in 1904, was followed by many others, both by the Bureau and by the Corps of Engineers, War Department. A plan to divert water from the Spokane River and other eastern tributaries of the Columbia was favored by the Bureau of Reclamation for many years, until it became apparent that water power development on the Columbia River at a major dam near the head of the Grand Coulee might make feasible construction of the dam to the dimensions needed for diversion direct from the main stream.

In 1927 the Corps of Engineers was directed to make the study which resulted in its "308" report on the Columbia River and tributaries, sent to Congress March 29, 1932. This report proposed a long-range development through a series of dams for power and other purposes on the Columbia River.

While this report was in preparation, however, on January 7, 1932, Bureau of Reclamation engineers presented another report which was included in the Corps of Engineers report, which held that the Grand Coulee Dam, as now constituted, was feasible and would repay its costs (*ENR* Jan.30.1932,p.907). This report was outlined by L. N. McClellan, electrical engineer, and Dr. Elwood Mead, then commissioner, of the Bureau of Reclamation at public hearings before the Irrigation and Reclamation Committee of the House in May and June, 1932.

Dr. Mead said before the committee at that time: "As I say, our thought in the first place was the reclamation of this land (Columbia Basin) and we were starting over on the east side, on the high ground, in order to have a gravity scheme. There were two reasons for that: One was that we could start with a less expenditure of money; and until we came to the Colorado River, we never had nerve enough to think of terms of hundreds of millions of dollars of expenditures. It was the cheapest plan to start, to come down by gravity, but as we went further and further into it, we found this: There was not water enough in the unregulated supply for us to irrigate that area, and we would have to have storage, a large amount of storage, and this added to the cost; and then the States of Montana and Idaho have an interest in the waters which have to be stored.

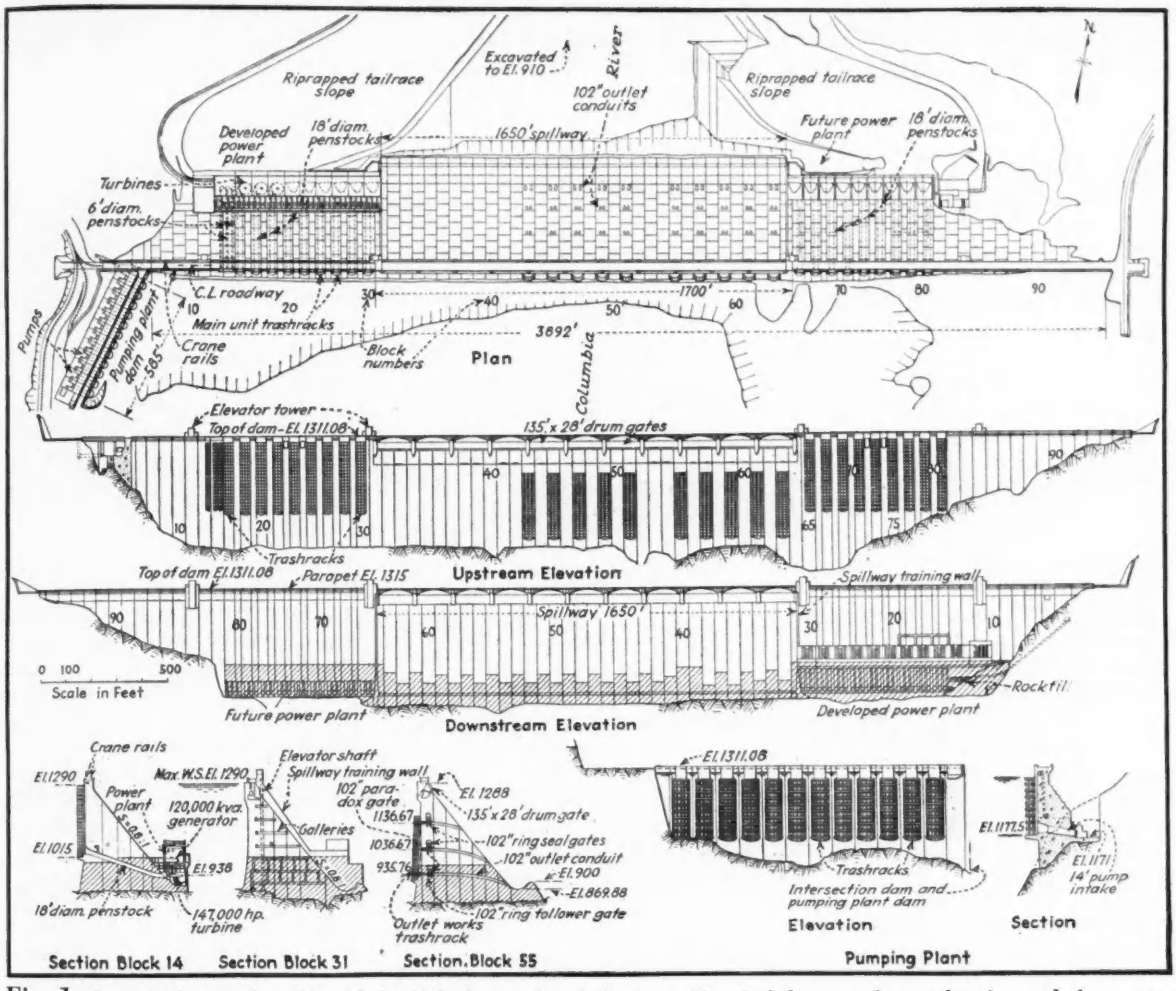


Fig. 1. General plans and sections of the high dam at Grand Coulee. The shaded areas of one elevation and three cross-sections represent concrete already placed under previous contract for the base of the dam.

"To start from the east side of the irrigable area the first step would be to adjust those rights, just as they have been settled on the Colorado, and those things lead to delays and to interstate complications.

"But over on the other side of this irrigable area is the Grand Coulee. From that part of the Columbia River, there is no problem of water shortage or of interstate rights, which has a water supply so abundant and so unclaimed that at one sweep all of these complications about water titles are removed. There is more water than could possibly be used except as it is used for power.

"Then, too, we came to realize that, while the greatest value to the country is the building of agricultural population, the best way to make it possible, without putting heavy burdens on irrigation is to join power development with irrigation development. Since the financial return from power in these works creates solvent investment for the Government and it has a social value in giving better light and power in farm houses and helping to pay the irrigators' charges."

When the allotment was made for start of the work on Grand Coulee Dam, then, the plans for the Columbia Basin project were well set.

The original allotment of $63,000,000 (later reduced) of Public Works funds was for the purpose of beginning the development by construction of a so-called low dam for power generation, with the expectation that eventually this dam would be raised to the height necessary to permit diversion of water for irrigation. The contract was let on this basis. About a year later, on June 7, 1935 when the contractor was engaged in excavating for the foundation of the dam, a change order was signed by Secretary of the Interior Harold L. Ickes. This was proposed by the engineers of the Bureau of Reclamation for two principal reasons: there was a question concerning the making of a proper bond between the low dam and the high dam which would eventually be super-imposed upon it; and a major slide of clay into the west excavation required removal of more overburden than had been anticipated in the construction of the low dam, thus the excavation of the entire foundation area for the high dam was favored as being more economical. Also, commencement of construction of Bonneville Dam, near Portland, subsequent to the allotment of funds for the low dam at Grand Coulee, indicated that the immediate demands of the power market

which the low dam would serve might be taken care of and that the high dam at Grand Coulee could be completed and synchronized into its proper place in the water power field without the necessity for construction by two stages.

The bids opened on December 10, 1937, involve the contract for completion of the dam to its full height for use as a diversion structure, with the aid of pumping, for the irrigation project, and power generation.

Finances

The original allotment of Public Works Funds for construction of the low dam at Grand Coulee for power production was $63,000,000. After a few months, however, part of this sum was rescinded, leaving $15,000,000, or only enough for the first year's construction, available. A second allotment of $19,800,000 from funds of the Emergency Relief Act of 1935 assisted in carrying the work forward, and subsequently the Congress twice has appropriated money for continuation of the work; appropriating $20,750,000 for the 1937, and $13,000,000 for the 1938 fiscal years.

At the conclusion of the M.W.A.K. contract, covering the base of Grand Coulee Dam, approximately $10,000,000 of the funds for construction will remain unexpended on this project and this sum will be available for work under the new contract covering completion of the dam. There is no doubt that this sum will be sufficient to see the new work through to the 1938 fiscal year.

In order that the rising dam shall not become an insurmountable obstacle to the salmon run up the Columbia River prior to the period in 1938 when this run occurs, the specifications for completion of the dam put limitations upon the amount of concrete which may be placed prior to October in the spillway section of the dam. By the time of the 1939 salmon run, provisions are expected to have been completed for trapping the fish at Rock Island and planting the fingerlings in waters tributary to the Columbia River below Grand Coulee Dam.

It is estimated that Grand Coulee Dam and reservoir will cost on completion a total of $128,450,000, of which the dam will cost $118,123,000; the ultimate power installation, including switchyard, substation and transmission lines, $71,000,000 and the irrigation canals and the balancing reservoir in Grand Coulee $195,000,000. It is unlikely that any work will be commenced on the balancing

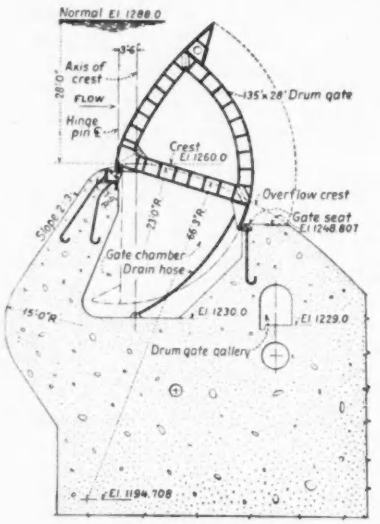


Fig. 2. Section of drum gate, eleven of which will control the discharge over the spillway. Gates are 28 ft. high, 135 ft. long.

reservoir or the canal system until the dam itself is nearly completed. The canals for the irrigation of the Columbia Basin lands will be constructed as needed to develop the irrigable area; that is in a series of comparatively small systems designed to serve approximately 150,000 acres each. After the dam and the balancing reservoir in the Grand Coulee are completed, the annual expenditures necessary to maintain an orderly construction program for the irrigation of the lands will probably be about $5,000,000 a year. It is not anticipated that the entire project will be completed within several decades.

In addition to the obvious services of Grand Coulee Dam, that of providing a water supply for 1,200,000 acres of land and that of the generation of power at the dam, additional benefits will accrue from its construction.

Maj. John S. Butler, of the Corps of Engineers, author of one of the important reports on the dam, stated at the hearing before the House Committee on Irrigation and Reclamation in 1932 that provision of 5,028,000 acre-ft. of useful storage at Grand Coulee Dam would double the firm power output of all present and prospective dams below Grand Coulee Dam and above the mouth of the Snake River and materially increase the firm power out-put of dams between the mouth of the Snake River and the mouth of the Columbia River at plants to be built there. It has been estimated that the increase in the firm power at plants in this latter stretch of the river which will result from equalization of the Columbia's flow at Grand Coulee dam will amount to 50 per cent. Bonneville Dam is in this stretch of the river.

Grand Coulee Dam will create a reservoir with a capacity of almost 10,000,000 acre-ft., of which more than 5,000,000 acre-ft. is usable storage.

This reservoir will be of value in equalization of the flow of the river, resulting in reduction in flood peaks and improvement in navigation. Grand Coulee Dam is the key structure of the system of ten dams proposed by the Corps of Engineers for development of the Columbia River. It is the uppermost in the series, utilizing all of the fall between the Canadian border and the mouth of the Grand Coulee, 151 miles downstream.

It is estimated that when completed the power plant will have an annual capacity of 8,320,000,000 k.w.-hr. of firm power and 4,200,000,000 k.w.-hr. of secondary energy.

Of the secondary energy, a maximum of 2,260,000,000 k.w.-hr. will be used ultimately in pumping water out of the reservoir created by Grand Coulee Dam into the balancing reservoir in the Grand Coulee itself above. The maximum flow of the Columbia River, and therefore the period during which secondary power is produceable in largest quantities, occurs during the irrigation season when the pumps must be run.

Grand Coulee Dam will raise the water in the storage reservoir about 350 ft. above ordinary river level, and pumps will lift it 280 ft. more to the balancing reservoir in the Coulee.

Plans for the high dam were prepared in the Denver office of the Bureau of Reclamation under the direction of R. F. Walter, chief engineer, and J. L. Savage, designing engineer.

Unit prices on the new contract are on advertising page 20.

A New Stadia Technique

by JOHN A. OAKEY
Columbia University, New York City

A redesigned rod and readjusted instrument effects improvements in speed and accuracy of stadia work

PERCEPTIBLE SAVINGS in time in taking stadia shots, as well as marked reductions in the number of errors, have been obtained by the writer by the use of a modified form of stadia rod and a change in the standard adjustment of the transit.

In taking a stadia shot, the instrument man must make four distinct operations: 1. Set the center horizontal wire on the height of instrument (H.I.); 2. Raise or lower the field of vision until either the bottom or top horizontal wire coincides with the nearest whole foot mark. 3. Count up the stadia reading. 4. Reset the center horizontal wire on the H.I. preparatory to reading the vertical angle. The writer has so modified the standard stadia rod that the bottom wire can always be set on the zero of the rod, eliminating steps 2 and 4 and simplifying step 3.

Details of the rod appear in Fig. 1. The modified rod consists of a conventional stadia rod with a foot which is adjustable so that the zero of the rod can be set a distance equal to the H.I. above the end. The writer uses a model which will accommodate any H.I. between 4.0 and 5.5 ft. The adjustable leg shown in Fig. 2, is graduated in 0.1 ft. to facilitate setting. The two members of the rod are held together in much the same way as the two members of a Philadelphia rod.

Transit readjustment

Before this type of rod can be used, it is necessary to readjust the transit or alidade. The instrument is so readjusted that, when it is levelled up and the telescope bubble is centered, the line of sight through the *bottom* horizontal wire is level and the vertical vernier is set on zero. Before the adjustment is made it is desirable to shift the wires upward in the field of vision so that somewhat more of the field is visible below the bottom wire. This brings the bottom wire more nearly to the center of the field of vision and also brings the line of sight and the axis of collimation of the telescope closer together.

To make this readjustment, it is only necessary to set up the instrument on level ground and establish a point about two or three hundred feet away at the same elevation as the telescope. Then, the cross-hairs having been raised any convenient amount, the bottom wire is sighted on the established point and the telescope bubble centered by means of the bubble adjustment. The vertical vernier is then shifted so that it reads zero. It will be noted that this readjustment in no way disturbs the instrument's usefulness for other purposes.

Procedure used

The use of the modified rod and the readjusted instrument markedly simplifies the taking of stadia shots. Let us assume that the instrument has been moved to a new set-up point. The H.I. is measured, and the rod is set so that the zero point is above the end of the rod a distance equal to the H.I. The rod is then ready for all shots taken from this set-up, and need not be reset until the instrument is moved. For any one shot, the instrument man merely sets the lower wire on the zero of the rod and reads the upper wire. This removes two steps from the observing program. The center wire need be used only on exceptionally long shots for double intercept reading.

The standard formula and tables for adjustment of distance for vertical angle can be made without in-

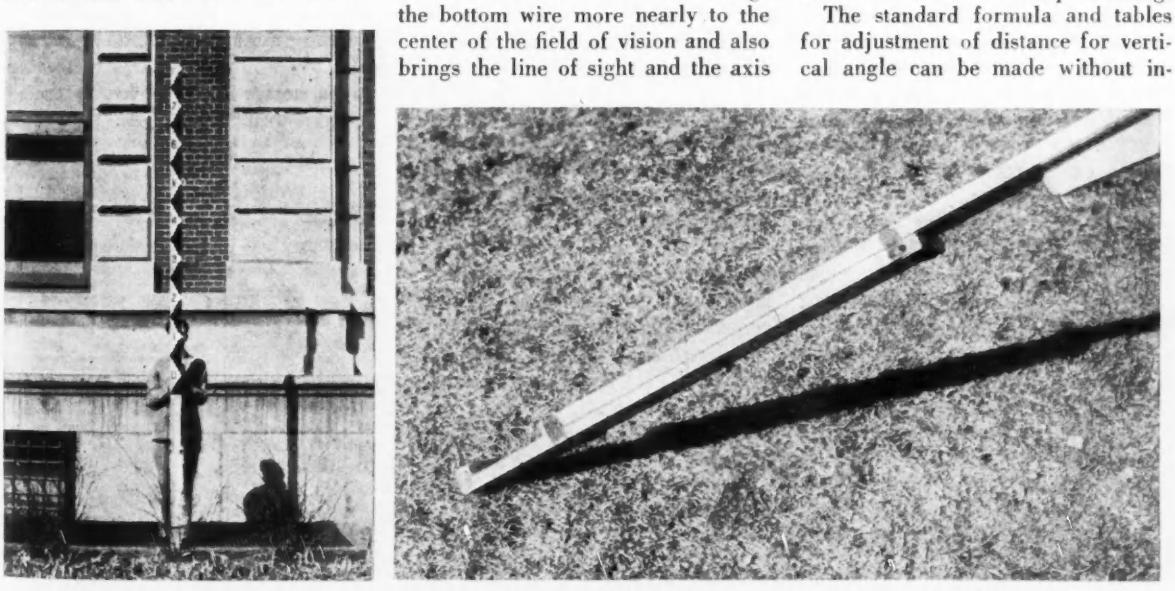


Fig. 1. **Modification of the conventional stadia rod to permit making zero coincide with the height of instrument simplifies napping operations.**

troducing an error greater than one per cent at an angle of 45 deg.

Advantages of the method

The use of the described rod and method possesses three distinct advantages: Two steps are removed from the observing program, thus resulting in a saving of time. Tests which the writer has made show that the saving averages 12 sec. per shot, about one-half the time of the conventional stadia shot.

The stadia reading is not counted up, but is read directly as the intersection of the upper wire on the rod. This greatly reduces the possibility of error and at the same time reduces the time of taking the stadia reading.

The zero of the rod is usually located about 5 ft. above the ground, and all observations are above this point, thus reducing to a large extent the interference from brush, tall grass and refraction.

It has been objected to the new method that since the line of sight does not coincide with the axis of collimation of the instrument, errors will be caused when the focus of the telescope is changed. To test whether these errors are important, the author established the elevation of the 100-ft. point of a line 700 ft. long on level ground. The readjusted instrument was then set up and levelled at one end of the line. Rod readings were taken on all seven stations to the nearest 0.01 ft. and in no case, for these shots varying in length from 100 to 600 ft., was there a detectable difference between the observed and computed readings. Apparently this error is so small as to be undetectable for the degree of accuracy in stadia work.

The writer recently completed a 70-acre topographic survey on which he used the described rod and method. Topographic and climatic conditions were such that the work progressed slowly and the saving in time obtained by the use of the new method was negligible. However, the lack of interference from brush, grass, and refraction and the feeling of confidence the writer had in each stadia reading, due to the fact that it was read directly instead of counted up, proved very helpful. After the work was plotted, not a single stadia reading in the 700 taken appeared to be in error.

FROM FIELD AND OFFICE

Working problems and time-saving methods . . . Edited by Charles S. Hill

Matching Photographs For Panoramas

by HAROLD K. PALMER
Santa Monica, Calif.

In taking the photographs which are to form a panorama, theoretically the camera should be turned about the lens as the center of motion. Some view cameras, using a tripod, are so built that this can de done, but unless there is detail within a few feet of the camera it is not absolutely essential. However, the photographer should turn the camera about a center which is within a few inches of the lens.

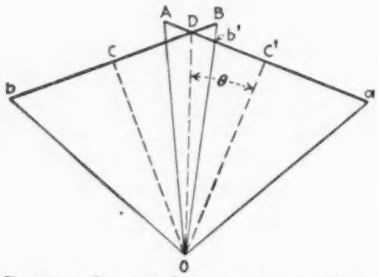


Diagram for matching panorama photographs.

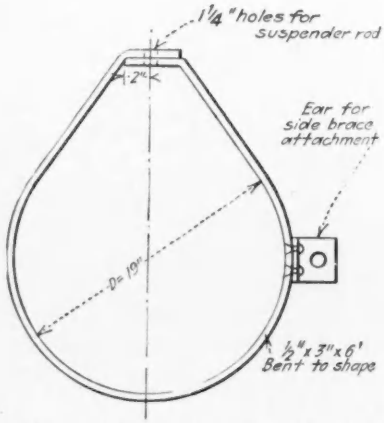
Some over-lapping between two adjacent views is necessary. Using a tripod and viewing the full size image on the ground glass this can be limited to less than ½ in., but with a hand camera and finder the uncertainty is often so great that a larger over-lap is necessary. In the accompanying figure *Aa* and *Bb* represent the two photographs in the relative position in which they are taken, and *O* is the lens. The over-lap on *Aa* is represented by the length Ab^1. It is evident that an object at b^1 on *Aa* will be at *B* on *Bb*, but since *OB* is greater than Ob^1 the corresponding scale on *Bb* at this point will be greater than on *Aa*. If *Aa* should be trimmed at b^1 corresponding images along the junction line of the two photographs would not match. The scale at any point is proportional to Sec θ,θ being the angle between the perpendicular to the film passing through the lens, or the axis of collimation, and the object. To make the two photographs match they should be cut at *D* where $CD = C^1D$.

The exact point *C* or C^1 is indeterminate on the actual photographs, though it is near the center if a well-constructed camera is used. Actually to match the photographs, first find the approximate amount of overlap and trim a little less than half this amount from *Aa*; test the matching by superimposing *Aa* on *Bb* and if the scale on *Aa* is larger than on *Bb* cut a little more off of *Aa*, and repeat the process until a good match is found. Then, and not until then, *Bb* should be trimmed at the corresponding point and the two views pasted to a splice on the back. If there are more than two views the process should be repeated for the other junctions.

• • •

New Pipe Hanger Saves Breakage

The pipe hanger illustrated has been used in hanging a 16-in. water main under a three-span concrete-arch bridge at Cedar Rapids, Iowa. Experience with breakages of pipe hangers where the upper portion had been bent closely around the top of the pipe and then both ends bent sharply upward and drawn together by a horizontal bolt, led to the design shown. The 1¼-in. supporting



Improved form of hanger for large pipe

rods were taken from stock, having been used long ago for lowering an intake pipe into the river. They had been threaded the full length for the intake job. To prevent side sway ears were rivetted to one side of the hanger straps and a side brace carried to the transverse concrete beams spaced on 7 ft. 10-in. centers. A 1-in. waterproof cork cushion was placed between beam and pipe and the nuts on the hanger rod supports tightened to hold the pipe to the beam. Thus each pipe joint takes its share of expansion and contraction. From ¼- to ⅜-in. clearance was left in the pipe joints.

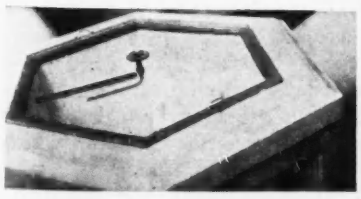
In placing the pipe, all supports and scaffolding were hung from the bridge which consists of six 103-ft. clear span arches. Scaffold for a single span made in the shop was hung from the deck by 1-in. rods extended through holes drilled from the top of the deck slab. The paving bricks were removed in the roadway for one row of holes; the other row was in the sidewalk. Materials were placed by lowering them over the rail to a scow and then lifting them to place by an air hoist.

The pipe was placed under the bridge by the construction crew of the water department under the general direction of H. F. Blomquist, superintendent of waterworks, with B. F. Hazen, superintendent of construction, directly in charge.

• • •

New Use for Windshield Wiper

A windshield wiper removes condensation from the underside of a glass over an observation well into a clear water basin of the water purification plant at Cedar Rapids, Ia. Attendants and visitors looking through 8 ft. of water can note any slight turbidity left from the treatment that transforms a turbid water into a turbidity-free supply. Four drop lights with water-tight cords and marine-lamp sockets are located near the bottom of a white and black tile-covered floor. The wiper is revolved by a handwheel attached above the glass to a brass rod threaded through a hole which is protected by gaskets.



Windshield wiper cleans window of turbidity well

• • •

Log-Crib Bridges

by Frank B. King
Civil Engineer, Oklahoma City, Okla.

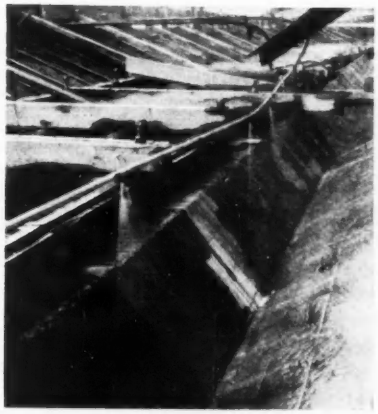
Sturdy bridges across torrential streams were provided by log cribs filled with stone in building forest truck roads with C.C.C. forces in southeastern Oklahoma. These trails are single-lane (10-ft.) roads located with forester's compass and Abney level and constructed with tractor, scarifiers and graders. Drainage was secured by side drains and ditch checks. In many places, where the material was suitable, the trails were graded with an outward slope and water allowed to cross the road. In other places dips were provided to take the place of culverts. Some open-top wood drains were used in places but proved unsatisfactory. Stream crossings were built with log framework filled with stones to provide suitable fords. On the Mountain Fork, a river about 300 ft. wide, low water bridges were built. These were constructed, as shown by the illustration, of log cribs filled with rock and a roadway built with logs for stringers and sawed plank for floors. Two such bridges spanned this stream and successfully withstood floods 15 to 20 ft. above them. All streams had solid rock bottoms where good foundation and anchorage were to be had.

Stone-filled log-crib bridge on forest road.

Spray Nozzles Keep Concrete Wet

by Daniel McFarland
Mason City, Wash.

The concrete in the Grand Coulee dam is poured in blocks 50x50 ft. and other odd sizes. The tops and sides must be sprinkled continuously. The tops of the blocks are sprinkled by men with hose, one man taking care of several blocks, alternating from one to another. Mechanical sprinklers were tried here but they interfered with the workmen too much and the workmen would turn off the water.



Pipe with spray nozzles

On the vertical and sloping faces this objection did not apply, so pipes were fastened to the movable form panels and were moved up with them. The small spray nozzles are set in the pipe at intervals and give a fine spray that does not leave an excess of water flowing from the foot of the vertical face. Galvanized ½-in. pipes are used and hose connections are used at the ends of the panel so that each panel may be raised independently.

Bituminous Roads Studied

Engineers gathered at Memphis National Asphalt Conference and the annual meeting of Asphalt Paving Technologists see need for wider research

IF THE CONCLUSIONS to be drawn from the four-day deliberations of the seven hundred engineers assembled in Memphis for the National Asphalt Conference were to be summarized in a few words it would be that further progress in bituminous paving depends on two things: first, recognition of the fact that no surface can stand up without adequate foundation, and second, fuller and more coordinated road materials and their uses. Though the discussions covered many elements of road construction and of research into paving materials, these two considerations continually were brought to the fore in one way or another. Also notable was evidence of wider recognition of the progressive hardening of asphalts in service and the added signs of a trend toward the use of slow curing oils in preference to medium and rapid curing oils. This trend was evident at the recent Montana Bituminous Conference.

Nominally the gathering was made up of two groups, one of the research and field men who constitute the association of Asphalt Paving Technologists, which group held its annual meeting Dec. 6 and 8, and the other the producers and users of asphalt materials who met Dec. 7 and 9 as the Eleventh National Asphalt Conference under the auspices of the Asphalt Institute. Actually the two groups functioned as a unit with no overlapping sessions, thus permitting everyone to participate in the consideration of all papers.

Research problems

Papers presented at the sessions of the paving technologists were concerned with adhesion between bituminous materials and aggregates, weathering, hardening and cracking of asphalts, service tests and other correlation to physical tests, mineral fillers, and the structural design of flexible surfaces. Summaries of these papers will be published in a subsequent issue.

J. Strother Miller, president of the association, at the opening session of the general conference briefly summarized the studies now in progress, some of which were reported in detail in papers at other sessions. Mr. Miller urged the setting up of a clearing house for the many valuable papers that are presented at the meetings of users and producers of asphalt paving materials so that better progress can be made toward solution of the many problems now facing the industry.

A major need at the present time, said Mr. Miller, is a test that will show quickly whether a satisfactory pavement has been produced. We have many tests for materials and processes, he added, but no way of testing the materials after they are on the highway to determine whether they have been proprly combined to form an adequate and lasting pavement.

Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, drew attention to the need for fuller and more orderly research and called on the producers to put up the funds to make such research possible. He recommended that it be conducted under the auspices of the Highway Research Board.

Mr. MacDonald pointed out that a high degree of uncertainty exists as to qualities of asphalts due to the fact that asphalt is essentially a by-product coming from a wide variety of sources. In support of Mr. Miller's call for coordination of research, he said that the industry must learn how to handle asphalts to prevent injury to them in producing the finished pavement. The highway engineer's interest is in the finished product and the industry must work to eliminate the blind spots in existing specifications.

Unfavorable trends in highway economics noted by Mr. MacDonald include the transfer of more and more funds from state highway departments to local units coupled with the transfer of added mileage of secondary roads to state control. This results in an overload on the state authorities and a cut in the efficiency with which the total available funds are spent. The effect of this trend has been disguised by increases in federal funds allocated to state road work in recent years, he said. If these funds now are cut the overload on state highway departments will be only too apparent.

No cut in road funds

Added emphasis to the significance of what Mr. MacDonald said concerning curtailment of federal aid to highways was given by Willard Chevalier, president of the American Road Builders Association and publishing director of *Engineering News-Record*. Colonel Chevalier called upon his hearers to combat spread of the belief, so widely expressed in daily papers, that federal-aid is a form of pork-barrel spending, and that it can be reduced without serious results. Except for funds used to eliminate grade crossings, he said, every dollar put out of the federal treasury for highway work must be matched by stat funds, which is not true of other federal expenditures. Also, the grade crossing funds and those assigned to farm-to-market roads make up a large part of recent increases in federal expenditures for roads and thus represent the cost of newly-adopted federal policies. Thus comparisons of today's expenditures with those of a decade ago are meaningless. In the meantime growth in motor vehicle registrations and road use, coupled with obsolescence of old roads, have made more rather than less highway construction imperative.

Local highway matters were briefly reviewed by M. O. Allen, commissioner, Tennessee Highway Department, and by G. S. Covert, representing R. A. Harris, chief engineer, Mississippi Highway Department. Tennessee is not going to cut expenditures on its roads to balance its budget, said Mr. Allen, and he urged that no federal cut be made for like purposes.

In Mississippi the department has just completed putting under contract practically the entire $42,000,000 of work authorized under a state highway program inaugurated in 1936.

Subgrade stabilization

Stabilization of base courses with bituminous materials was the subject of several papers. E. F. Kelley, chief of the division of tests of the Bureau of Public Roads, reviewed present knowledge of soil stabilization and pointed out that while most of our present knowledge of this subject has been gained in the past decade, the pioneer application to roads of what is now recognized as a distinct science was made as far back as 1917 by C. N. Strahan of the University of Georgia in his studies of soil materials for sand-clay roads.

Mr. Kelley urged recognition of the fact that the characteristics of mechanically stabilized mixtures for road surfaces and for base courses are not the same. A stabilized material that has functioned satisfactorily as a wearing course, if subsequently covered with a bituminous material which eliminates evaporation losses, may fail completely due to softening resulting from the capillary rise of moisture.

As to bituminous materials used as stabilizers, Mr. Kelley said that it is important to understand that bitumen so used is not primarily a binder but a medium for producing a high degree of immunity from the deleterious effect of water; such mixtures generally are too friable to withstand the abrasive action of traffic and must be protected by a wearing surface. Further, bituminous materials that are most satisfactory for surfacing are not necessarily the best for base stabilization. Research may show that less expensive materials can be used for the latter.

Details of the application of bituminous stabilization to special road problems in various parts of the country were given by H. C. Weathers (Florida), A. C. Tilley (Nebraska), F. V. Reagel (Missouri), L. L. Allen (Minnesota), and W. K. Beckham (South Carolina). In Florida stabilized materials have been used both as a base for low-cost surfacing and as sub-grades for concrete pavements.

In the sand-hill region of Nebraska the scarcity of clays and gravels has resulted in the use of liquid asphalts to stabilize road surfaces. This work was begun in 1928. At the end of this year there will be 252 miles of road so treated. Up to 1934 the top five inches was treated uniformly using a formula developed by extensive study, but in 1935 a two-course treatment was adopted, cutting the bitumen content of the lower two-thirds to 80 per cent of that called for previously, thus making a saving of about 1/6 of the oil in the base. However, this saving was largely offset by added mixing costs. This year a further modification was determined upon in which the oil content of the entire mix is cut to 85 per cent and a seal coat is added. The average cost of a 24-ft. pavement runs from $5,000 to $7,000 per mile.

Three types of bituminous treatment are used in Missouri: machine mix, blade mix, and sub-oiling. In stabilizing base courses with bituminous materials it has been found necessary to add some friction producing material.

Mr. Reagel said they have found that a existing gravel or crushed stone roads that have been stable are sometimes made unstable by blanketing them with a bituminous top, the blanket causing excess moisture to work up into the old material.

Experience with bituminous materials in stabilizing the gumbo soils of Minnesota is limited, said L. L. Allen. Minnesota highway engineers have found that bituminous mats must not be thin, also that in silty clays too much bituminous oil tends to work to the surface being replaced with moisture from below.

Clays found in the eastern part of South Carolina are unsuitable for sand-clay roads and experiments with asphalt stabilization of bases there have shown satisfactory results.

Use of quarry wastes

The possibility of reducing street paving costs by using stabilized quarry and gravel pit waste as the base for high-grade pavement was placed before the conference by L. H. Taylor, maintenance engineer, Oakland, Calif. Very satisfactory results have been obtained in Oakland using emulsified asphalts, care being exercised to avoid the soap emulsions. Base courses have been made much thicker than would be possible with costlier materials, thus obtaining greater load distribution at an actual saving in cost.

Surface treatments

The harmful effect on the base course of waterproof surfacing under certain conditions, noted by earlier speakers, was also noted by W. H. Wood, Texas Highway Department, in a paper on selecting asphalt products for various types of surface treatment. Mr. Wood outlined the characteristics of naturally loose surfacing materials and those that have bonding qualities and enumerated the types of oil needed for each, giving reasons why other types have proved less satisfactory. In discussion of this paper, J. C. Akers, Nashville, cautioned against excess of asphaltic oils or tars. Needed oil can be added, he said, but it can't be taken out. Open type penetrations have been used successfully in Tennessee. They produce a non-skid surface and take much less oil than was previously considered necessary to hold the road together.

Medium curing asphalts

Use of medium curing asphalts in plant and road mix as discussed by J. W. Powers, Arizona Highway Department. As a guide to determining the amount of oil Arizona uses the amount of the soil to be treated that passes a 200-mesh sieve. Mr. Powers noted that surfaces treated with medium curing oils are not susceptible of being reworked after they have been done some time. This statement was challenged in discussion; such reworking has been done in many places. The aggregate used seems to be the controlling factor in determining whether or not it can be reworked.

Oil aggregates have been used for resurfacing in Michigan only since 1935, according to V. B. Steinbaugh, hence available information relates

chiefly to construction methods. Plant-mix has been found more satisfactory than road-mix and plant-mix simplifies the problem of keeping roads open to traffic. Sands and gravels are used almost exclusively in Michigan although slag and crushed rock have been tried. In specifying mixes it is planned to obtain complete coating of the aggregate with oil without putting in enough to cause bleeding. Temperatures are not permitted to get above 250 deg. as high temperatures increase hardening. The plant-mix material is laid on any well drained base in half widths, depths generally being 6 in., but 8 in. is used on unstable soils. Mechanical spreaders have been found better than graders. Costs average $3.25 per ton for the mix with 1,500 tons per mile, $315 per mile for the base priming coat, $100 per mile for grading, a total of $5,290 per mile. The life is estimated at from 8 to 10 yr.

Cracking eliminated

Close technical control of bituminous mixes in Massachusetts has been fully justified by results, according to George H. Delano, chief engineer of the department of public works. Cracking that was a chief cause of trouble in the past has been largely eliminated by seeing that mixes are not overheated. Studies have shown that asphalts can be softer than those used a few years ago, but soft materials alone are not the solution for the softer asphalts are more vulnerable when overheated. It is essential that mixture be manufactured at temperatures that do not drive off volatile oils. Temperatures in the mix are maintained around 150 deg. by pre-cooling the aggregate with a special oil.

California's experience with asphaltic concrete pavements were reviewed by Earl Withycombe. Costs have been cut greatly in recent years by improvements in mixing plant design, there being a wide range in design to meet a variety of materials and conditions. Automatic proportioning gives very satisfactory results and is now called for in all plants meeting large contracts.

Taking his hearers farther up the West Coast, R. H. Baldock, state highway engineer of Oregon, told of Oregon's success with bituminous macadams. Fundamental to a road whose total annual cost is to be low, said Mr. Baldock are (1) a well drained roadbed, (2) a base course adequate to spread the load, and (3) well graded aggregate properly bound with bituminous material. Voids in the base course will absorb any excess bitumen in the course.

Both for safe driving and to reduce glare at night the surface texture must be such as to reduce water film at the surface to a minimum, according to Mr. Baldock. The methods now used in Oregon are producing such results. Costs, including a ballast course 12 to 24 in. thick placed on the subgrade as a foundation for the pavement, range from $10,000 to $20,000 per mile.

Mr. Baldock laid special stress on the need for an adequate foundation as essential to success with the high wheel loads that are common today. In Oregon great logging trucks subject the highways to very high load concentrations. A like warning was given by G. A. Draper, research engineer of the Mississippi highway department. Mississippi has a similar problem to Oregon in the concentrations which are produced by logging trucks. Density of traffic has little effect on the life of a pavement, Mr. Draper explained; it is the concentrated loads of trucks that destroy pavements which lack adequate foundations.

Consideration of bituminous roads closed with the discussion of replies to a questionnaire on problems relating to the use of asphalt products. Commenting on the wide range of opinions expressed in the replies, H. H. Houk, Alabama, said that this was understandable as problems are not the same in any two regions. The chief thing to be learned from such a study is whether the approach to the problems of a particular region is the proper one.

W. W. Zass, Arkansas, reporting on a study of mechanical equipment, said that the manufacturers had done much to develop better machines for bituminous roads, but that further economies in costs are to be made.

Other asphalt uses

Uses for asphalt other than for roads were the subject of four papers. Col. W. F. Tompkins, New Orleans, in an illustrated talk, described the work done by the army engineers in developing asphalt mats for bank revetment along the Mississippi River. Since development of a plant to manufacture such mats was begun in 1933 refinements in the process have brought costs down to 15c. per sq.ft. or $100 per lineal foot of river bank. Colonel Tompkins believes that reinforced asphalt mats have great possibilities for bank protection at many points other than the Mississippi.

Asphalt paving for reservoir and canal lining and for protection of earth dams from wave erosion was described by J. E. Buchanan, research engineer of the Asphalt Institute. Several examples of satisfactory waterproofing of reservoirs in the porous soils of California were cited by Mr. Buchanan, including the 6-in. mixed-in-place lining of Iron Mountain reservoir on the Colorado River aqueduct. This method of protection has been widely used in the Los Angeles flood-control work.

Sidewalk construction along rural highways using asphalt was the subject of a paper by W. A. Hardenbergh, vice president, *Public Works*, New York. This paper included a compilation of all existing specifications of state highway department for rural sidewalks.

Airport runways

W. Sumpter Smith, principal aeronautical engineer of the WPA, reviewed the work done by that agency in airport construction and outlined the peculiar problems faced by those charged with the construction of airport runways. Colonel Smith urged those familiar with asphalt construction for roads to contribute of their experience in solutions of the airport problems.

Financing airport work is a serious question in view of present uncertainty as to future requirements. Runways built ten years ago are now obsolete. This raises questions as to what minimum life should be provided for a pavement laid today. Colonel Smith says at least three years. By that time it should be possible to predict requirements for a much longer period.

Colonel Smith said that within the next 20 years 1,800 towns of 5,000 population or over will require some form of airport. Of these, 1,000 will be built within the next five years and will cost in the neighborhood of $150,000,000.

THE WEEK'S EVENTS

(Continued from page 1006)

Urge Airport Control By Commerce Dept.

Congress will probably be asked to put regulation of public airports under the Department of Commerce and to provide for federal subsidies for airport construction. A committee was named to study the question at a meeting Dec. 6-7 of leaders of the air transport industry, municipal executives, and the Bureau of Air Commerce of the department.

It was brought out at the meeting that current trends in airplane design necessitate continually larger airports. This trend has already made many municipal airports inadequate, and it was said at the meeting that financing of improvements is proving difficult because there is no assurance that an improved airport might not itself become inadequate within a few years.

The regulatory powers over airports would be given to the Bureau simply by striking the phrase "except airports and terminal landing fields," from that section of the Air Commerce Act of 1926 which places the airways under authority of the Secretary of Commerce.

Federal subsidies for public airports are expected to be arranged somewhat in the manner of federal aid for highways, with local governments matching federal funds.

Fresh evidence of the increase in airplane sizes was given Dec. 10 when Pan-American Airways asked for designs and bids on three to twenty-four 100-passenger airplanes for transoceanic service. The planes, to be known as Yankee Clippers, are to have a minimum payload of 25,000 lb. for a 5,000-mile non-stop flight and a sea level cruising speed of 200 miles per hour; a cruising speed of 300 miles an hour is asked at an elevation of 25,000 feet.

• • •

Federal Aid Roadbuilding Sets Record in 1937

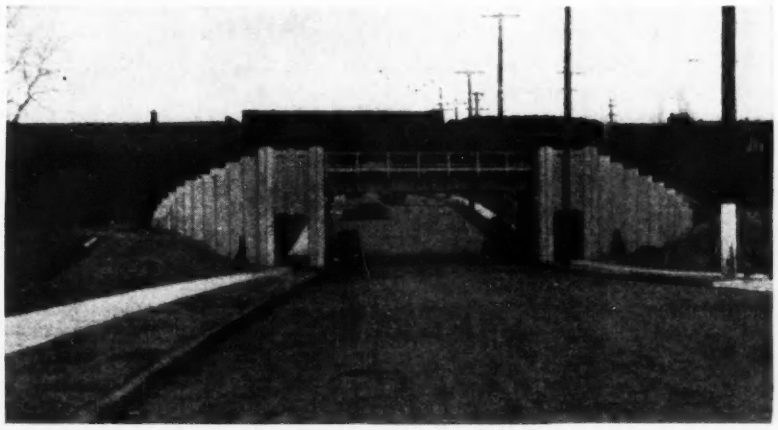
With more than 22,000 miles of all classes of highways brought to completion in the fiscal year 1937, the Bureau of Public Roads supervised more road construction than in any previous year. The previous record, set in 1934, was 21,700 miles. Grade crossing elimination and protection work in 1937 also far surpassed that of any other year. 1,149 crossings were eliminated, of which 1,086 were financed under the $200,000,000 grade crossing program authorized by the Emergency Relief Appropriation Act of 1935.

Of the completed roads, 18,768 miles were constructed with funds apportioned to the states. This work included 10,257 miles on the federal aid system outside of municipalities, with a federal contribution of $155,282,000; 1,093 miles of extensions of the system into and through municipalities, with $59,689,000 of federal money; 571 miles of secondary roads in municipalities at a cost to the government of $27,380,000; and 6,847 miles of secondary roads outside of municipalities, with federal funds of $77,282,000. These figures for federal contributions include work at grade crossings.

Big Exhibit Planned At Road Show

Four hundred exhibits of the newest roadbuilding machinery and materials will be an outstanding feature of the 1938 Road Show and convention of the American Road Builders Association at Cleveland Jan. 17-21. The displays will occupy every foot of available floor space in the Cleveland public auditorium. Attendance of about 20,000 road builders from every state in the country and from 25 foreign countries is expected.

Convention sessions of the committee on safe highways and the attendant exhibition of equipment for building safety into highways will mark the culmination of a nation-wide safety campaign. Sessions will also be devoted to other current questions, including highway planning, soil stabilization, gas tax diversion, education of highway engineering students, development of highway construction equipment, and highway legislation.



NOTABLE HIGHWAY IMPROVEMENTS AT COLUMBUS

THESE striking underpass structures are part of extensive highway improvements being carried out at the west side of Columbus, Ohio. *Top*—Unusual architectural treatment of concrete abutments is a feature of a new underpass on the C. & O. R.R. track elevation project. *Bottom*—Dual roadway and stone-faced masonry and steel bridges are part of the new Olentangy Boulevard extension. The C. & O. R.R. bridge is in the foreground.

BRIEF NEWS

A MUNICIPAL housing authority for Baltimore has been authorized by a resolution of the city council. The mayor is given power to name the members of the authority.

THE CITY of Linton, Ind. has been ordered by the state to stop polluting the Bee Hunter Ditch. The order directs the city to build a sewage disposal plant before Jan. 1, 1939. At present sewage disposal for the city is furnished by a septic tank which the state claims has been overflowing into the ditch.

A MUNICIPAL power distribution system may properly be acquired and operated by the city of Clarksville, Tenn., according to a ruling by Chancellor Marable. The Chancellor's opinion denied a petition of the Kentucky-Tennessee Light and Power Co. for an injunction restraining the city from issuing bonds and from entering into a contract with the TVA.

A GIFT of $300,000 from the Maurice & Laura Falk Foundation to the Carnegie Institute of Technology will support a program of education and research in social relations. The foundation will establish a professorship of social relations at Carnegie, and the holder of this position will have charge of the new educational program. The chair will be known as the Maurice Falk Professorship of Social Relations. The program will consist of a group of social and cultural courses in the College of Engineering and also of a continuing research study of social relationships in industrial and business life.

ALL WPA WORKERS in New York City are to be rated on the basis of efficiency, it has been announced. Standards for the rating system have already been worked out and the first comprehensive check on efficiency will be made next month. A similar survey will be made in the spring to check the original rating.

TOLL CHARGES in the Lincoln tunnel, which is to open Dec. 22, will be on the same single-trip basis as in the Holland tunnel and on the George Washington bridge—50 cents per passenger vehicle. An innovation is a reduced combination ticket, to be sold for 75 cents, which will permit a motorist to use any one of the three Hudson River crossings in connection with any one of the three Staten Island bridges.

A CORRESPONDENCE COURSE in public works engineering has been introduced by the International Correspondence Schools.

MINIATURE railroads intended only for children are being built in the Soviet Union. Thirty lines are now under construction, all patterned after one at Dniepropetrovsk which has a locomotive and six cars for rolling stock and a 1½ km. roadbed.

SWIMMING POOLS in the state of Illinois will be inspected regularly and the sanitary rating of each will be made public, beginning in 1938. Samples of water will be taken at intervals and tested for streptococci as well as other evidences of contamination. This supplements a present provision of Illinois law that no swimming pools for public use can be constructed in the state without a permit and approval of plans by the state department of public health.

• • •

Fluorine Found in Water Of Chicago Suburb

Suburban towns lying west of Chicago may abandon their present deep-well water supply and obtain water from Lake Michigan in the future because of a high fluorine content in the underground supply revealed by a study of the teeth of school children at Elmhurst, Ill. The study, made by Dr. Charles Deatherage, chief of the division of general health of the Illinois Health Department, indicated that the mottled enamel index is too high, while a study of Elmhurst water by Clarence W. Clarence, state sanitary engineer, has revealed the presence of two parts of fluorine per million.

The Elmhurst surveys are believed to be typical of conditions in nearly a hundred other communities in this area.

• • •

Tennessee River Bridge Planned by Alabama

Financing plans have been completed for building a highway bridge across the Tennessee River just below Wilson Dam, it was announced by Governor Graves of Alabama, Dec. 4. The bridge will cost $1,650,000, of which the Alabama Bridge Commission will contribute $950,000 from the proceeds of a bond sale and the state highway commission will contribute $700,000 from federal aid funds. Construction will be under the supervision of the state highway department.

The bonds will be repaid from bridge tolls of 15 cents for private cars, and 5 to 60 cents for trucks.

PERSONAL

HOWARD S. REED, formerly director of PWA in Arizona, has been appointed chief engineer of the Arizona highway department, succeeding the late Thomas S. O'Connell.

H. H. LAUER, for the past few years administrative officer of the cement plant project of the Puerto Rico Reconstruction Administration at San Juan, returned to New York this month to practice consulting engineering on cement and industrial plants.

WALTER M. SMITH has retired from his position as chief engineer of the Illinois Division of Waterways, but he will remain with the division as consulting engineer and in charge of maintenance operations, with headquarters at Joliet.

CARTER JENKINS has been appointed chief engineer of the Division of waterways, Illinois Department of Public Works and Buildings. For the past four and a half years Mr. Jenkins has been with the U. S. Department of the Interior as assistant regional officer in charge of federal work on state parks in Illinois, Indiana, Wisconsin, and Michigan. Besides heading the Division of Waterways, Mr. Jenkins will now serve in an advisory capacity to the Illinois Division of Parks. Before his connection with the Department of the Interior, Mr. Jenkins practiced as a consulting engineer in the Chicago metropolitan area with the firm of Allen & Jenkins, and before that he had served five years with the Illinois division of highways as supervising engineer in the Chicago district.

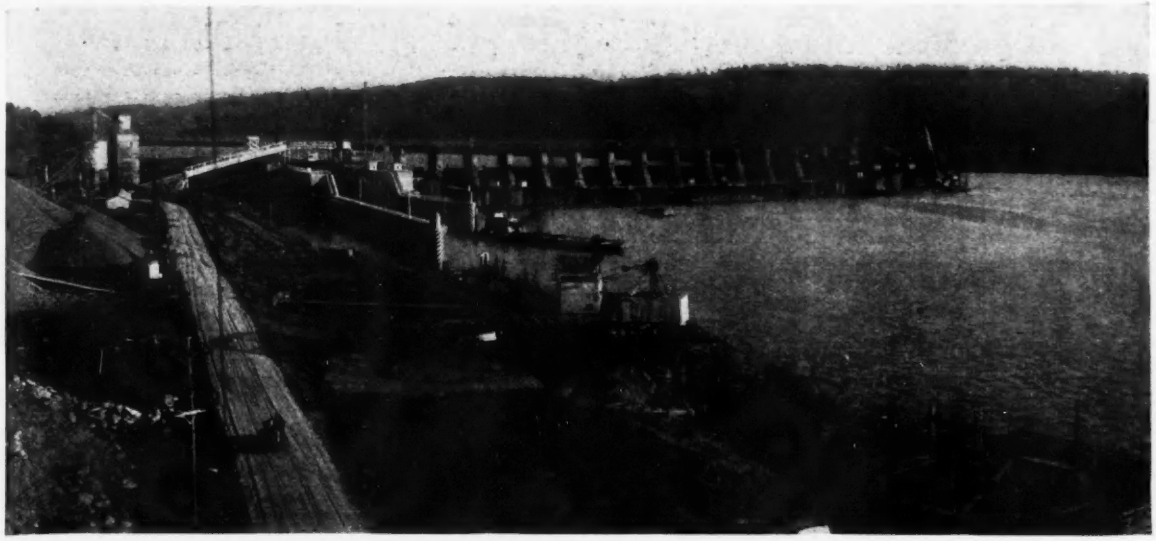
CECIL D. WIGHT, land surveyor in the Ottawa engineering department, has been appointed assistant water works engineer for the city to succeed the late A. D. Stalker.

E. K. HALL has been appointed assistant chief engineer of the Board of Railway Commissioners at Ottawa, succeeding A. J. K. Drury, retired.

LLOYD P. ROBSON, former acting superintendent of the highway department of Oswego County, N. Y., has resigned from the department.

WILLIAM F. CALLAHAN has been appointed commissioner of the Massachusetts department of public works.

COL. ELLIOTT J. DENT has retired from the Army after more than 40 years of active service in the Philippines, in Peurto Rico, in France and Germany during the World War, and at numerous stations in the United States.



GUNTERSVILLE DAM ENTERS THIRD STAGE

THE SECOND cofferdam of Guntersville dam, TVA river control project on the Tennessee River, is being removed, and the third cofferdam is being placed, inaugurating the third stage of construction of the dam. The same steel sheet piles that were used in the second coffer are being pulled and used for construction of the new cofferdam.

The new coffer, composed of interlocking cells of sheet piling, will form three sides of a rectangle, extending out from the south bank for a distance of about 400 ft. and paralleling the south bank for a distance of about 1,000 ft. After it is completed, the area it encloses will be unwatered and excavation will start for the foundations of the three remaining spillway openings and for the power house.

At the present time the dam consists of a completed earth embankment on the north bank of the river, an earth embankment about 50 per cent complete on the south bank, and concrete work for about 720 ft. of spillway located in the river channel and until now enclosed by the second cofferdam. The navigation lock has been in temporary operation for some time; it is completed except for the upper mitre sill, which will be the last piece of construction work on the lock. Until this mitre sill is placed, temporary lock gates are in operation on the upstream end of the lock chamber.

His last active duty was at Baltimore, where he was district engineer and at the same time a member of the Board of Engineers for Rivers and Harbors, the Beach Erosion Board, and the Shore Protection Board.

JOHN DIBBLEE, engineer on the staff of the Ontario Hydro-electric Power Commission since 1917, has been made assistant chief engineer of that body.

RAY E. LAWRENCE, formerly Kansas state PWA director and earlier assistant engineer of the Kansas State Board of health, has joined the organization of Black & Veatch, Kansas City consulting engineers.

HAROLD R. HOOPER, engineer in the Ottawa waterworks department, has been made assistant engineer of distribution.

ELYWN E. SEELYE and Gilbert D. Fish have formed a partnership to practice consulting engineering in the welding field. They have opened offices in New York City.

HAROLD ROWLEY has been named district highway maintenance supervisor at Everett for the Washington state highway department. He has been with the department for eleven years and has recently been stationed at Seattle.

M. W. TORKELSON, WPA Administrator for Wisconsin, has resigned to resume his work as head of the state planning board.

FRANK BACHMANN, in charge of sanitary engineering and marketing for The Dorr Co., is now on a world survey or sanitary engineering projects.

E. KELS HALL has been appointed assistant chief engineer of the Board of Railway Commissioners of Canada.

55-Mile Fencing Contract Let by Water District

Entering into what is stated to be the largest contract for fencing ever let in this country, the Metropolitan Water District of Southern California has awarded a $188,000 contract for 55 miles of fence to the Anchor Post Fence Co. of Baltimore. The 6-ft. chain-link fence will be erected around the reservoirs and on both sides of the open section of the Colorado River aqueduct in the Imperial Valley desert.

Temporary Compromise On Connecticut Roads

Pending final disposition of a legal dispute, now in the hands of the Connecticut Supreme Court of Errors, regarding jurisdiction over highway construction in Connecticut, a temporary compromise arrangement has been worked out by which Commissioner of Public Works Hurley and Commissioner Macdonald of the Connecticut State Highway Department will share responsibility for federal-aid roads in the state. Both Mr. Hurley and Mr. Macdonald will sign contracts which may be awarded during the period, and they will handle federal-aid funds jointly.

Commissioner Macdonald is now in full charge of town aid projects, while Commissioner Hurley is supervising trunk line and state-aid work.

The controversy concerns interpretation of a law passed by the last session of the legislature which vested control of the capital structures of the state in a new Department of Public Works. The question of whether this allocation of responsibility includes construction of highways is now in the courts.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

National Paving Brick Association, annual meeting, Netherlands Plaza Hotel, Cincinnati, Jan. 12-14.

American Engineering Council, annual convention, Washington, D. C., Mayflower Hotel, Jan. 13-15.

Secretaries of Engineering Organizations, annual conference, Washington, D. C., Mayflower Hotel, Jan. 13-15.

American Road Builders Association, road show and convention, Cleveland, Jan. 17-21.

American Wood Preservers Association, annual meeting, Chicago, Congress Hotel, Jan. 18-20.

American Society of Civil Engineers, annual meeting, New York City, Jan. 19-21.

National Rivers and Harbors Congress, 33rd convention, Mayflower Hotel, Washington, D. C., Jan. 20-21.

Purdue Road School, annual school and road show, Purdue University, Lafayette, Ind., Jan. 24–28.

Engineering Institute of Canada, annual meeting, London, Ont., Jan. 31-Feb. 1.

American Concrete Contractors Association, National Concrete Masonry Association, National Cinder Concrete Products Association, Cast Stone Institute, joint convention, Hotel Sherman and Medinah Athletic Club, Chicago, Feb. 7-11.

Associated General Contractors of America, annual convention, Willard Hotel, Washington, D. C., Feb. 8-10.

American Institute of Mining and Metallurgical Engineers, annual meeting, Engineering Societies Building, New York City, Feb. 14-18.

Association of Highway Officials of North Atlantic States, annual convention, Hotel Ambassador, Atlantic City, N. J., Feb. 16–18.

REGIONAL AND LOCAL

Louisiana Engineering Society, annual meeting, St. Charles Hotel, New Orleans, Jan. 7-8.

University of Colorado, Highway Engineering Conference, Boulder, Colo., Jan. 13-14.

New Jersey Association of Professional Engineers and Land Surveyors, Elks Club, Jersey City, N. J., Jan. 14-15.

New York State Sewage Works Association, annual meeting, New York City, Jan. 20-22.

North Carolina Society of Engineers, annual meeting, Raleigh, Jan. 28-29.

Southwest Road Show and School, annual session, Wichita Exhibition Building, Wichita, Kan., Feb. 22-25.

ELECTIONS AND ACTIVITIES

The Name of E. V. Roussell, chief building inspector of Oakland, Cal., was incorrectly given as P. K. Rossele in a note in the issue of Nov. 25, p. 875, which told of his election as vice president of the Pacific Coast Building Officials Conference.

At a Meeting last month the Wisconsin Section, American Water Works Association, elected the following officers: Chairman, W. U. Gallaher; vice chairman, W. C. Staeffler; new director, A. E. Hintz; national director, Arthur H. Miller; secretary-treasurer, Leon A. Smith.

The Structural Engineers' Association of Northern California at a recent meeting elected Harold B. Hammill as president for 1938 and Sidney S. Gorman as vice president. New directors are H. M. Engle, Sidney S. Gorman, Frederick F. Hall, Harold B. Hammill and A. V. Saph, Jr.

Recently elected officers of the Iowa Section of the A.S.C.E. are: President, R. E. Robertson; vice president, A. H. Wheeler; secretary-treasurer, R. B. Kittredge.

Earl H. Morris has been elected president of the West Virginia Society of Professional Engineers.

Life Memberships were awarded last month to the following members of the Sacramento Section, A.S.C.E.: Jeremiah Ahern, J. C. Boyd, R. B. Marshall and Emery Oliver.

• • •

License Examinations

New York: Examinations for professional engineers at New York, Albany, Syracuse and Buffalo, Feb. 1-3. Examinations for land surveying, Feb. 4.

Michigan: Examinations for civil engineers and surveyors at the University of Detroit, Michigan State College, the Michigan College of Mining and Technology, and at Ironwood, Dec. 29-31.

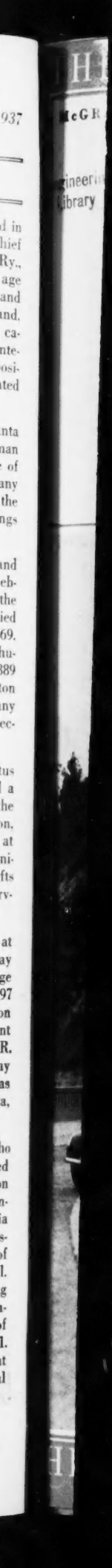
OBITUARY

Morris S. Blaiklock, who retired in 1931 from his position as assistant chief engineer of the Canadian National Ry., died in Montreal, Nov. 25, at the age of 78. Mr. Blaiklock joined the Grand Trunk Ry. in 1880 as a draftsman, and, rising through various engineering capacities, he became engineer of maintenance of way in 1907, holding that position until 1922 when he was appointed assistant chief engineer.

Lee Lewman, head of the Atlanta construction firm of M. P. Lewman Co., died in Kansas City, at the age of 68. Mr. Lewman's firm had built many important buildings throughout the South including the Georgia Savings Bank Bldg. in Atlanta.

Harry H. Hunt, vice president and former chairman of the Stone & Webster Service Corp. and a director of the Stone & Webster Engineering Co., died Nov. 30 in Boston at the age of 69. Mr. Hunt was a graduate of Massachusetts Institute of Technology in 1889 and worked for the Thompson Houston Co. and the General Electric Company before practicing as a consulting electrical engineer in Boston.

Gardner C. Anthony, dean emeritus of the Tufts Engineering School and a former president of the Society for the Premotion of Engineering Education, died at New Rochelle, N. Y., Nov. 29, at the age of 82. Mr. Anthony, a mechanical engineer, was connected with Tufts teaching staff from 1893 to 1927, serving as dean for 29 years.

J. S. Morrison, district engineer at Ottumwa for the Iowa State Highway Commission, died last month at the age of 63. After his graduation in 1897 from Iowa State College, Mr. Morrison served in the engineering department of the Chicago & Northwestern R. R. In 1914 he joined the Iowa highway department and shortly afterwards was appointed district engineer at Ottumwa, where he remained until his death.

G. L. Conrad, consulting engineer who practiced in Brownsville, Tex., died there Nov. 24. After his graduation from Ohio State University, Mr. Conrad joined the staff of the Pennsylvania R. R. and a few years later was assistant division engineer in charge of construction of the Detroit River tunnel. From 1910 to 1914 he was supervising engineer for the Union County Irrigation District in Texas, predecessor of the Willacy County District No. 1. He then became county engineer at Brownsville, resigning after several years to go into private practice.